The Foundry Trade Journal

AND

PATTERN-MAKER.

THE OFFICIAL ORGAN OF THE BRITISH FOUNDRYMEN'S ASSOCIATION.

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THE FOUNDRY TRADE JOURNAL,
165, Strand, London, W.C.

BRITISH FOUNDRYMEN'S ASSOCIATION.
LIST OF SECRETARIES.

General Secretary: J. F. H. Allbutt, Sheepbridge House, Chesterfield.
Manchester: C. Carson Bransby, 113, School Road, Stretford.
Birmingham: C. Heggie, 76, Hillaries Road, Erdington, near Birmingham.
Cardiff: R. Griffiths, Messrs. J. Williams & Sons, Ltd., Globe Foundry, Cardiff.

BRITISH FOUNDRYMEN'S ASSOCIATION.

The Officers.

At the Sheffield Conference the following were elected to be officers of the British Foundrymen's Association during the ensuing year.

President: H. Pilkington, M.Inst.C.E. (Sheepbridge Coal and Iron Company, Limited.)

Vice-Presidents: F. J. Cook, of Messrs. Bellis & Morcom, Limited, Birmingham; and P. Longmuir, Consulting Metallurgist, Sheffield.

President, Birmingham Branch: R. Buchanan (Messrs. Chamberlain & Hill, Limited, Walsall).

President, Cardiff Branch: C. Jones, (Messrs. Chas. Jones, Ninian Foundry, Cardiff).

President, Manchester Branch: W. H. Sherburn (Messrs. Keynons, Warrington).

Council: W. F. Bagnall (Messrs. Bagnall Bros., Shalesmoor Foundry, Sheffield), J. Ellis (Messrs. Thornycrofts, Southampton), Thos. McFarlane (The Horsehay Company, Limited, Salop), S. A. Gimson (Messrs. Gimson Bros., Leicester), R. W. Keynon (Messrs. Keynons, Accrington), P. Munnoch, Metallurgist, Middlesbrough, R. Mason (Messrs. Eagle Range Company, Birmingham), Jas. Oswald (Messrs. J. Oswald & Son, London), W. Roxburgh, Kilmarnock, N.B., and W. Vickers (Messrs. Bellis & Morcom, Limited, Birmingham).

Treasurer: C. Morehead (Messrs. Willans & Robinson, Rugby).

Secretary: J. E. H. Allbut, Sheepbridge House, Chesterfield.

The Council held their first meeting since the annual Sheffield Convention on Saturday, September 7th. The Sheffield meeting was reported to be the most successful the Association has yet held. Mr. C. Morehead was unanimously appointed treasurer, *pro tem.* The secretary reported that the printing of

the annual proceedings was being dealt with, and it was hoped the copies would soon be in the hands of the members. Other important business was transacted.

Birmingham Branch.

THE Autumn Session of the Birmingham Branch of the British Foundrymen's Association was inaugurated on Saturday, September 21, by a smoking concert at the Acorn Hotel, Birmingham, Mr. R. Buchanan, District President, in the chair. There was a large attendance.

The PRESIDENT, in a brief opening address, expressed the hope that the session would prove equally pleasant and profitable. They were all feeling the benefit of holidays. Many of them were at the Sheffield Conference, and they would all agree in regarding that visit as a splendid time. They had received the greatest possible kindness from everyone, especially at the works they visited. The present time was one of considerable anxiety to the foundry trade. He was not sure that they were not now on the top of the wave, and possibly a little on the wrong side of it, as regarded the volume of business. The disturbing element, he considered, was the condition of the coal trade. They could have no confidence with regard to the future while the present inflation existed. The colliery owners and the men settled their difficulties very amicably by raising prices and wages, and handing over the financial liability to the public. Those friendly agreements might go too far for the general welfare. It was very difficult to obtain from the public the cost of the raw materials used by the founder, and many prices would very properly recede if coal did not dominate the situation. They could not have cheaper iron without cheaper fuel. He feared that if coal either advanced or even maintained its present figure, worse days were in store for the iron trade. He congratulated them on the scientific and technical papers they had had in the past, and the attention such subjects had received. It seemed to him that the next thing that foundrymen might very properly consider was the improvement of their general culture. They should read those works of general literature which had received the stamp of time, because of their value and usefulness. It was not readily provable that such general culture had an immediate monetary value, but such works were valuable in setting forth the highest aspects of life, and it was immensely valuable to be able to get away from the worries and cares of the foundry into a higher and larger atmosphere. They could do that by cultivating the great English poets, writers of general literature, and novelists.

In conclusion, the PRESIDENT read the following draft of the syllabus for the coming session :—

October 26, Presidential Address.

November 23, Professor Turner, "Crystallisation in Cast Iron."

December, Mr. G. Hailstone (date and subject to be afterwards stated).

January 25, Mr. A. H. Hiorns, "The Influence of Carbon in Iron."

February 29, Mr. Stocker, "Foundry Castings."

March 28, Mr. Fraser, "Notes on Contraction."

April 25, General Meeting.

May 23, Mr. Parker, "The Testing of Alloys."

He thought that would be an excellent programme, and the Secretary was in correspondence with various firms with whom they hoped to make definite arrangements for a series of visits.

A musical programme followed, contributed by Mr. J. T. Breakspear, and a party of vocalists.

THE PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

THE first autumn meeting of the Philadelphia Foundrymen's Association was held on September 4. The feature of the evening was a description of the universal system of machine moulding of Messrs. Ph. Bonvillain & E. Ronceray. The remarks about the machines were made by E. H. Mumford, of the E. H. Mumford Company, which has undertaken the American agency for the sale of these machines, in addition to its own.

Previous to Mr. Mumford's talk a report was made on the winding-up of affairs of the recent annual convention of the American Foundrymen's Association, in which the very gratifying statement was made that over $9,000 had been collected for the entertainment of visitors and that less than half of this had been spent, so that there remained for contributors a dividend of 50.08 per cent. of their subscriptions, which had been returned to them.

ANALYSES OF BRITISH PIG-IRON.

LANCASHIRE.

Barrow Hematite Steel Co., Ltd.,

BARROW IN-FURNESS.

Brand—"B.H.S."

	Carbon.	Si.	S.	P.	Mn.
No. 1	3.650	2.942	0.050	0.050	0.537
„ 2	3.480	2.750	0.050	0.050	0.520
White	3.400	0.658	0.348	0.062	0.076

Wigan Coal and Iron Co., Ltd.,

WIGAN.

Brand—"K.H."

	G.C.	C.C.	Si.	S.	P.	Mn.
Foundry	2.20	0.80	2.80	0.06	0.75	2.00
Forge	1.30	1.70	1.80	0.07	0.80	1.80
Ferro manganese	—	7.00	0.50	nil	0.25	80.50
Spiegeleisen ...	—	5.17	0.60	tr.	0.06	20.60
Silico Spiegeleisen	—	2.10	10 17	„	0.07	20.00

LEICESTERSHRE.

Holwell Iron Co., Ltd.,

ASFORDBY, NR. MELTON MOWBRAY, LEICESTERSHIRE.

Brand—"Holwell."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry ...	3.350	—	2.612	0.022	1.190	0.490
„ 2 „ ...	3.650	—	2.473	0.036	1.173	0.403
„ 3 „ ...	3.850	—	2.379	0.041	1.190	0.403
„ 4 „ ...	3.350	—	2.333	0.047	1.255	0.389
„ 4 Forge ...	2.971	—	2.331	0.056	1.088	0.484
„ 5 „ ...	1.750	—	1.376	0.062	0.929	0.245
Mottled	1.540	—	1.261	0.225	0.970	0.217
White	0.840	—	1.049	0.305	0.937	0.188
Glazy	2.500	—	4.850	0.028	1.285	0.532

LINCOLNSHIRE.

Appleby Iron Co., Ltd.,

FRODINGHAM, LINCOLNSHIRE.

Brand—"Doncaster."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 ...	3.012	0.185	2.25-2.75	0.25	1.30-1.40	1.70
„ 3 ...	3.030	0.200	2.25-2.50	0.30	1.30-1.40	1.70

Frodingham Iron and Steel Co., Ltd.,

FRODINGHAM, NEAR DONCASTER.

Brand—"Frodingham."

	G.C.	C.C.	Si.	S.	P.	Mn.
Best Basic	—	—	0.75	0.07	1.50-2.00	1.50-2.00
Common „	—	—	0.75	0.12	1.50-2.00	1.00-1.50
Siliceous „	—	—	1.30	0.10	1.50-2.00	1.00-1.50
No.3 Foundry	—	—	2.00	0.05	1.50	1.80
„ 4 „	—	—	1.80	0.07	1.50	1.80
„ 4 Forge...	—	—	1.70	0.08	1.50	1.50
Close 4 ...	—	—	1.60	0.09	1.50	1.30
No. 5	—	—	1.50	0.10	1.50	1.30

North Lincolnshire Iron Co.,

SCUNTHORPE, DONCASTER.

Brand—"N.L.B."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry ...	—	—	2.87	0.032	1.27	1.37
„ 3 „ ...	—	—	2.16	0.036	1.22	1.33
„ 4 „ ...	—	—	1.87	0.041	1.24	1.31
„ 4 Forge... ...	—	—	1.80	0.048	1.22	1.26
Basic	—	—	0.75	0.070	1.50	1.50

Redbourne Hill Iron and Coal Co., Ltd.,

FRODINGHAM.

Brand—"Redbourne."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3 Foundry ...	3.100	0.560	2.751	0.038	1.326	1.680
„ 4 „ ...	2.816	0.751	2.610	0.045	1.318	1.589
Grey Forge ...	2.525	0.895	2.508	0.056	1.316	1.456
No. 4 Close ...	2.459	0.945	2.452	0.059	1.296	1.314
Mottled	1.480	1.520	1.325	0.100	1.296	1.130
White	0.675	2.285	0.450	0.155	1.295	1.100

William Shakespeare,

TRENT IRON WORKS, FRODINGHAM.

Brand—"Trent."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3 Foundry ...	3.00	0.30	2.50	0.03	1.30	1.80

NORTHAMPTONSHIRE.

Thomas Butlin & Co., Ltd.,

IRTHLINGBOROUGH IRON WORKS, WELLINGBOROUGH.

Brand—"Butlin."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.790	tr.	2.800	0.006	1.662	0.360
„ 2	3.190	tr.	1.980	0.010	1.672	0.360
„ 3	3.223	0.131	1.780	0.018	1.604	0.398
„ 4	3.077	0.141	1.910	0.023	1.659	0.248
Mottled	1.166	1.179	2.660	0.168	1.648	0.216

The Kettering Iron and Coal Co., Ltd.,

KETTERING, NORTHAMPTONSHIRE.

Brand—"Kettering."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.186	0.248	2.261	0.020	1.644	0.472
„ 2	2.680	—	2.230	0.030	1.620	0.320
„ 3	3.160	—	2.159	0.019	1.820	0.275

ANALYSES OF BRITISH PIG-IRON—*continued.*

P. Phipps' Executors,

HUNSBURY HILL IRON WORKS, NORTHAMPTON.

Brand—"Northampton."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 4 Grey Forge	3.46		1.900	0.014	2.092	—

The Wellingboro' Iron Co., Ltd.,

WELLINGBOROUGH.

Brand—"Rixon's W'boro'."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry ...	3.490	0.080	3.000	trace	1.496	0.288
,, 2 ,, ...	3.250	0.080	3.000	,,	1.434	0.288
,, 3 ,, ...	3.000	0.123	3.170	,,	1.390	0.183
,, 4 ,, ...	2.950	0.250	3.173	,,	1.306	0.180
Grey Forge ...	2.792	0.202	2.806	0.034	1.476	0.288

NOTTINGHAMSHIRE.

Bestwood Coal and Iron Co., Ltd.,

BESTWOOD, NEAR NOTTINGHAM.

Brand—"Bestwood."

G.C.	C.C.	Si.	S.	P.	Mn.
3.20	0.15	2.70	0.04	1.10	0.40

SHROPSHIRE.

Lilleshall Co., Ltd.,

SHIFNAL, SALOP.

Brand—"Lilleshall Lodge."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Cold Blast...	3.32	0.12	2.00	0.03	0.55	1.25
,, 2 ,, ,, ...	3.20	0.25	1.80	0.04	0.56	1.15
,, 3 ,, ,, ...	2.88	0.43	1.72	0.06	0.56	0.93
,, 4 ,, ,, ...	2.60	0.60	1.40	0.08	0.56	0.84

Brand—"Lilleshall H.B."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Hot Blast...	3.15	0.15	2.50	0.30	0.72	1.30
,, 2 ,, ,, ...	3.05	0.30	2.30	0.04	0.74	1.16
,, 3 ,, ,, ...	2.84	0.40	2.10	0.05	0.74	0.99
,, 4 ,, ,, ...	2.44	0.50	1.80	0.07	0.73	0.80
Basic	1.00	2.75	0.06	1.50	2.00	0.10

The Madeley Wood Co.,

MADELEY WOOD, SALOP.

Brand—"Madeley Wood."

	G.C.	C.C.	Si.	S.	P.	Mn.
Cold Blast—						
No. 3	2.672	0.858	1.026	0.047	0.658	1.657
,, 4	2.911	0.770	1.026	0.051	0.596	1.441

NORTH STAFFORDSHIRE.

R. Heath & Sons, Ltd.,

BIDDULPH VALLEY COAL AND IRON WORKS, NEAR STOKE-UPON-TRENT, STAFFS.

Brand—"Heath & Sons"; "R.H.S."

	G.C.	C.C.	Si.	S.	P	Mn.
No. 3	2.55	0.60	2.45	0.08	1.14	2.31
,, 4	2.60	0.51	1.95 to 2.05	0.07	1.09	2.20

Stafford Coal & Iron Co., Ltd.,

STOKE-UPON-TRENT.

Brand—"Fenton."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry ...	3.06	0.349	2.847	0.038	1.415	2.161
,, 2 ,, ...	2.68	0.497	3.453	0.041	1.390	2.089
,, 3 ,, ...	2.90	0.318	3.033	0.049	1.441	1.423
,, 4 ,, ...	2.72	0.225	2.690	0.047	1.623	1.657
Forge—Grey 4 ...	2.88	0.392	1.913	0.071	1.481	1.873
Open centre 4 ...	2.98	0.374	1.633	0.047	1.463	2.167
Close 4	2.42	0.836	2.193	0.074	1.592	1.588
Hard 4	2.44	0.369	1.587	0.126	1.501	1.160

SOUTH STAFFORDSHIRE AND WORCESTERSHIRE.

T. & J. Bradley & Sons, Ltd.,

DARLASTON BLAST FURNACES, DARLASTON.

Brand— (*Part Mine*).

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.50	trace	3.75	0.037	1.52	1.05
,, 2	3.10	0.25	3.10	0.048	1.50	1.10
,, 3	2.80	0.75	2.60	0.057	1.56	1.00
,, 4	2.50	1.00	2.10	0.054	1.50	1.00

Brand—"All Mine" (*Medium Quality.*)

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.50	trace	3.50	0.025	0.90 to 1.00	0.90
,, 2	3.20	0.25	3.00	0.040		0.90
,, 3	2.70	0.75	2.30	0.050		0.87
,, 4	2.50	0.90	2.00	0.070		0.85
,, 5	2.10	1.20	1.70	0.080		0.82
,, 6	1.60	1.60	1.50	0.080		0.80

Brand—"IXL All Mine" (*Best Quality*).

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 HB	3.60	trace	2.80	0.025	0.40	1.10
,, 2 HB	3.25	0.30	2.50	0.040	0.40	1.10
,, 3 HB	2.80	0.70	2.10	0.060	0.38	1.05
,, 4 CB	2.50	0.90	1.20	0.070	0.37	1.00
,, 5 CB	2.00	1.30	1.00	0.080	0.37	0.95
,, 6 CB	1.50	1.70	0.90	0.085	0.35	0.90

ANALYSES OF BRITISH PIG-IRON—*continued.*

Cochrane & Co. (Woodside), Ltd.,

WOODSIDE IRON WORKS, NEAR DUDLEY.

Brands—"*Woodside*"; "*C. & Co.*"; "*Adder.*"

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 4	3.046		1.218	0.133	0.419	0.828

M. & W. Grazebrook,

DUDLEY.

Brand—"*Grazebrook & Chilbrook.*"

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3	2.55	0.40	1.16	0.01	0.54	0.70
„ 4	2.40	0.50	1.00	0.07	0.50	0.64
„ 5	2.25	0.56	0.90	0.12	0.50	0.60

M. & W. Grazebrook,

NETHERTON IRON WORKS, DUDLEY.

Brand—

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.07	—	1.48	0.03	0.43	0.96
„ 2	3.04	—	1.27	0.04	0.34	0.80
„ 3	3.12	—	1.16	0.05	0.14	0.94
„ 4	3.03	—	0.83	0.01	0.31	0.27
„ 5	2.81	—	0.57	0 06	0.29	0.13

Alfred Hickman, Ltd.,

SPRING VALE FURNACES, NEAR WOLVERHAMPTON.

Brand—"*S.O.H.*"

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.72	trace	2.58	0.02	0.82	0.65
„ 2	3.70	trace	2.50	0.02	0.82	0.63
„ 3	3.50	trace	2.50	0.04	0.80	0.60
„ 4	3.02	0.03	1.59	0.06	0 75	0.54
„ 5	3.00	0.10	1.32	0.07	0.75	0 50

Wm. Roberts (Tipton), Ltd.,

TIPTON.

Brand—"*Roberts' Tipton Green Iron.*"

	Carbon	Si.	S.	P.	Mn.
No. 1	3.70	3.00	0.020	1.30	0.43
„ 2	3.50	2.50	0.025	1.30	0.43
„ 3	3.00	2.30	0 032	1.30	0.43
Forge	2.60	2,10	0.100	1.30	0.43

Philip Williams & Sons,

WEDNESBURY OAK WORKS, TIPTON.

Brand—

	G.C.	C.C.	Si.	S.	P.	Mn.
	2.50	0.50	1.00	0.08	0.50	0.55

Willingsworth Iron Co.,

WEDNESBURY, STAFFORDSHIRE.

Brand—"*Willingsworth.*"

	G.C.	C.C.	Si.	S.	P.	Mn.
Basic Iron	—	—	1.00	0.05	3.30	2.3

WILTSHIRE.

The New Westbury Iron Co., Ltd.,

WESTBURY, WILTS.

Brand—"*Westbury.*"

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry ...	3.45	0.20	3.00	0.016	1.70	0.17
„ 2 „ ...	3.35	0.20	2.55	0.038	1.70	0.18
„ 3 „ ...	3.20	0.35	2.56	0.040	1.70	0.18
„ 4 „ ...	2.42	0.44	2.70	0.010	1.74	0.16
Forge	1.70	1.30	1.50	0.030	1.65	0.17
White	0.20	3.20	0.91	0.085	1.62	0.13
Mottled	1.10	1.90	0.96	0.070	1.76	0.14

YORKSHIRE (North Riding).

Bolckow, Vaughan & Co., Ltd.,

MIDDLESBROUGH.

Brand—

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.00	0.10	3.00	0.03	0.05	1.00
„ 2	3.30	0.15	2.80	0.05	0.05	0.95
„ 3	3.25	0.20	2.60	0.06	0.05	0.95
"Cleveland," No. 3	2.37	0.10	3.33	0.05	1.51	0.70
"Clay Lane," No. 3	3.24	0.18	3.21	0.05	1.52	0.49
"Clay Lane," White	0.10	2.90	1.30	0.045	1.53	0.30

Cargo Fleet Iron Co., Ltd.,

CARGO FLEET IRON WORKS, MIDDLESBROUGH.

This firm only make a special class of pig-iron, and that solely for their own use.

ANALYSES OF BRITISH PIG-IRON—*continued.*

Cargo Fleet Iron Works,

MIDDLESBROUGH.

Brand—"Cargo Fleet."

	G.C.	C.C.	Si.	S.	P.	Mn.
Basic pig	0.70	3.00	1.00	0.05	1.60	1.20

Cochrane & Co., Ltd.,

MIDDLESBROUGH.

Brand—"Ormesby."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	3.231	0.000	3.206	0.047	1.426	0.576
,, 3 ...	3.150	0.080	2.780	0.068	1.352	0.525
,, 4 Foundry ...	3.131	0.118	2.865	0.064	1.429	0.627
Forge	2.700	0.730	1.700	0.164	1.450	0.612
Mottled	1.900	1.580	2.000	0.260	1.492	0.360
White	0.422	1.868	1.140	0.739	1.496	0.216
Siliceous	2.979	0.136	4.440	0.082	1.377	0.792

Gjers, Mills & Co., Ltd.,

AYRESOME IRON WORKS, MIDDLESBROUGH.

Brand—"Ayresome" Hematite.

	G.C.	C.C.	Si.	S.	P.	Mn.
Mixed Nos. ...	3.767	0.275	2.371	0.033	0.041	1.325
No. 1 Foundry ...	3.570	0.120	3.000	0.020	0.650	1.560

Sir B. Samuelson & Co., Ltd.,

MIDDLESBROUGH.

Brand—"B. S. Newport."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3	3.50		2.75	0.04	1.50	0.50

Skinningrove Iron Co., Ltd.,

SALTBURN-BY-THE-SEA, YORKS.

Brand—"Skinningrove."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3 ...	3.20	0.10	2.50-3.00	0.03-0.05	1.50	0.50

Walker, Maynard & Co.,

REDCAR.

Brand—"Redcar."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3 Iron—						
4 Samples ...	—	0.14	2.67	0.03	—	0.74
	—	0.14	2.67	0.02	1.65	0.76
	—	0.24	2.48	0.05	1.68	—
	—	0.22	2.61	0.04	1.67	0.80

William Whitwell & Co., Ltd.

THORNABY IRON WORKS, STOCKTON-ON-TEES.

Brand—"Thornaby Hematite."

	G.G.	C.C.	Si.	S.	P.	Mn.
No. 1	4.00	0.10	2.50	0.02	0.04	1.00
,, 2	3.85	0.15	2.40	0.03	0.04	0.90
,, 3	3.65	0.30	2.00	0.05	0.04	0.80
,, 4	2.80	0.06	1.50	0.10	0.04	0.65

Wilsons, Pease & Co., Ltd.,

TEES IRON WORKS, MIDDLESBROUGH.

Brand—"G. W. L."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 3	3.69	0.11	2.89	0.01	1.55	0.69

YORKSHIRE (West Riding).

The Farnley Iron Co., Ltd.,

LEEDS.

Brand—"Farnley."

	G.C.	C.C.	Si.	S.	P.	Mn.
Cold blast, No. 5	3.12	0.29	1.03	0.09	trace	0.46

Low Moor Iron Works,

BRADFORD, YORKS.

Brand—"Low Moor."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1	2.910	0.590	1.324	0.042	0.362	1.096
,, 2	2.960	0.560	1.389	0.050	0.398	1.065
,, 3	3.060	0.550	1.385	0.049	0.367	0.908
,, 4	2.870	0.680	1.154	0.064	0.384	0.899
,, 5	2.570	0.810	0.736	0.089	0.383	0.839

Newton, Chambers & Co., Ltd.,

THORNCLIFFE IRON WORKS, NEAR SHEFFIELD.

Brand—"Thorncliffe."

	G.C.	C.C.	Si.	S.	P.	Mn.
No. 1 Foundry ...	3.45	0.19	2.88	0.01	1.23	0.49
,, 2 ,, ...	3.11	0.20	2.72	0.02	1.18	0.56
,, 3 ,, ...	3.30	0.22	2.57	0.02	1.20	0.47
,, 4 ,, ...	3.04	0.27	2.00	0.04	1.18	0.56

MOULDING INSPECTION DOORS ON PIPE CONNECTIONS

Owing to the variety of the work embraced by the ironfounder, it has been found advantageous to divide the trade into different grades or branches, and as a natural consequence the specialising of certain classes of work has been the result.

It is on one of these specialised sections that we wish in the present article to

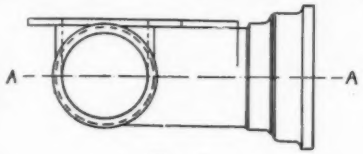

Fig. 1.

make some observations, viz., that branch of trade which is associated with the manufacture of cast-iron pipes, and work connected therewith.

The method we propose to discuss is by no means new, but it is one, with the principles of which, many who are connected with the foundry trade are not thoroughly conversant. The idea is submitted as not only interesting to pipe founders, but to the trade generally.

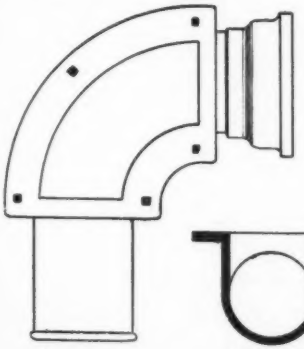

Fig. 2.

Fig. 3.

The principles involved are confined to no particular class of work for opportunities present themselves in all branches of the trade where these may be applied to advantage, and it is the aim of the writer to impress on all foundrymen the importance of making themselves thoroughly acquainted with this class of moulding by means of which a considerable saving at times may be effected. To illustrate the point to which we wish to direct attention, we have selected a special case from the class of work to which reference has been made, and our remarks will, therefore, have special reference to the method adopted in

Fig. 4.

moulding a pipe connection which turns up with great frequency, more especially where a trade is carried on in pipes used for sanitary purposes.

Cast-iron pipes for sanitary purposes

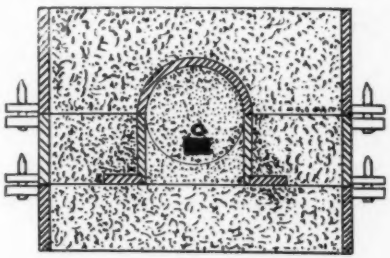

Fig. 5.

is a trade which is fast developing, and it is one in which pipe founders will in the near future be largely interested.

To meet the requirements which govern the laws of sanitary engineering, it is necessary when laying cast-iron drains to

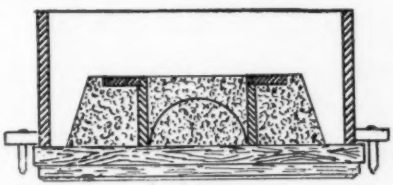

Fig. 6.

insert at intervals pipes provided with inspection doors, so that access to the drain may be obtained when desired.

It is to the moulding of these pipes with inspection doors, which may be

either "straights," "bends," or "branches," that we wish especially to refer.

In selecting this example, it will be necessary in the first place to give a description of the method formerly adopted with work of this class, and in this way we shall be in a better position to appreciate the advantages to be gained by the adoption of the method we propose to discuss.

Figs. 1 and 2 show an elevation and

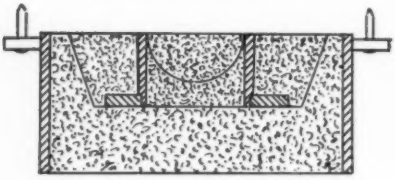

FIG. 7.

plan respectively of a bend with an inspection door, and Fig. 3 a section through the door.

It may be explained here that in pipe-foundry practice the patterns for this class of work are got up in iron, and are of the "shell" form, leaving their own core, the whole mould including the core being in green sand. A joint is made in the pattern, as indicated on Fig. 1 by the line A A, and the flanged, or projecting part, of the pattern is loose, a section showing how the parts come together being seen in Fig. 4.

The method used in moulding this article prior to the adoption of the system

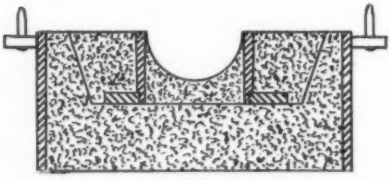

FIG. 8.

to which we desire to draw attention, was to make it in a three-part box, as shown in Fig. 5.

Assuming that the principles of moulding in a three-part box are generally well known, we shall pass it without further consideration, but we wish to point out that the chief objection to this method was the expense involved in supplying moulding boxes. A special box was necessary for nearly every size of pipe made, and as the sizes of pipes vary considerably, this was a serious objection, adding greatly to the cost of production, and the boxes were practically of no use for the general run of work.

The method which we now wish to describe entirely does away with the three-part box; two-part boxes used for ordinary work being quite suitable.

The method of procedure is as fol-

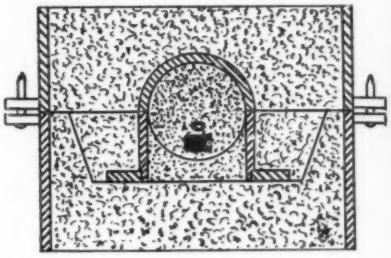

FIG. 9.

lows:—The pattern is prepared in exactly the same manner as that adopted when using a three-part box. The door half of the pattern is placed on a "laying-down" board with the loose flanged part in position, as shown in Fig. 6.

Sand is now rammed under the flange and between the walls of the pattern, and shaped to the form shown in sketch

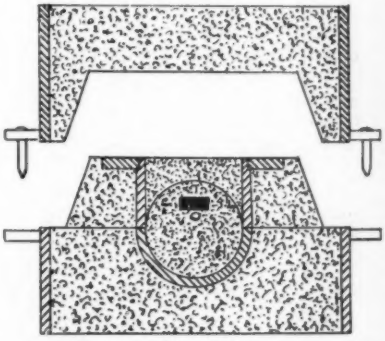

FIG. 10.

No. 6, the top of the sand being on the same plane as the face of the flange, and the sides well tapered as shown.

Parting sand is now distributed over the partly formed mould, and the bottom part of the box is placed in position and rammed up.

When this part of the mould is rammed

up it is turned over, and when the "laying-down" board is removed the mould should appear in section similar to that shown in Fig. 7.

The sand projecting inside the part forming the door is now fashioned to the same size as the inside diameter of the pipe, as shown in Fig. 8.

The core is prepared in the usual way

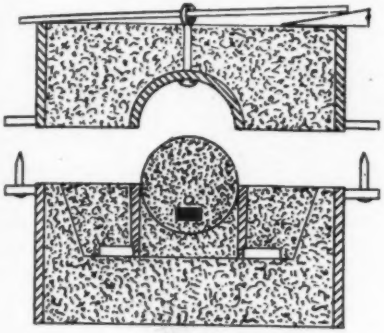

FIG. 11.

by ramming sand into the inside of each half of the shell pattern and bringing them together.

When this is done parting sand is now distributed over the mould and the other part of the moulding box is placed into position and rammed up.

A section through the complete mould

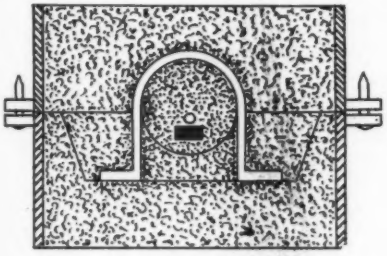

FIG. 12.

with all parts in position is shown in Fig. 9. The whole mould is now turned upside down and the part uppermost removed, the mould parting, as shown in Fig. 10.

The flanged part of the pattern which is loose, is now removed, and the two parts of the mould are again brought together.

The whole mould is again turned over, and takes up a position similar to that shown in Fig. 9, except that the flanged part is removed. The moulding box is again separated, and to ensure a good "part" the top part of the pattern is lifted with the top part of the moulding box, as shown in Fig. 11.

The core is lifted from the mould by means of the core bar, after which the bottom part of the pattern can be removed.

The side walls of the pattern forming the door, it will be noted, are tapered similarly to that of a box-part.

When the top and bottom halves of the pattern are withdrawn from their respective places, and the core replaced, the mould is ready for casting. A section through the finished mould is shown in Fig. 12.

In our description we have confined our remarks chiefly to the moulding of the door-part of the pipe connection, as it is this part which illustrates the form of moulding which we wished to consider, the other part of the work being treated just in the ordinary course.

We consider there is much ingenuity displayed in the foregoing style of moulding, and every foundryman, be he moulder or pattern-maker, should be conversant with the principles involved.

Not only is there less work for the moulder, but from an economical point of view a considerable saving in the cost of plant is obtained.

The one who first initiated the process deserves great credit, and possibly like the inventor of many other valuable improvements, his inventive genius has gone unrewarded.

—o—

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

THE first meeting of the Pittsburg Foundrymen's Association was held on September 9. Mr. Elliot A. Kebler, of Mathew, Addy & Company, read a paper on "Selling for the Foundry," advocating a better cost system for foundries, a closer check between original estimates and actual costs, and the elimination of guesswork. W. B. Robinson read a paper on "Publicity," pointing out the value of trade papers both as a buying and selling agency and as a corrective influence. Thos. B. West and Dr. Richard Moldenke were unanimously elected honorary members of the Association.

C

SOME MODERN MOULDING MACHINES.

MODERN moulding machines may be divided into three kinds, viz., machines with lifting pins, with turntables, and with stripping plates.

In the machine with lifting pins, three or four round bolts are carried vertically through the pattern-plate in such a way that their tops are on a level with its surface. The pins are lifted upwards simultaneously, either by eccentric or by toothed gearing, and thus draw the pattern from the mould by lifting up the box. After this the box rests loosely on

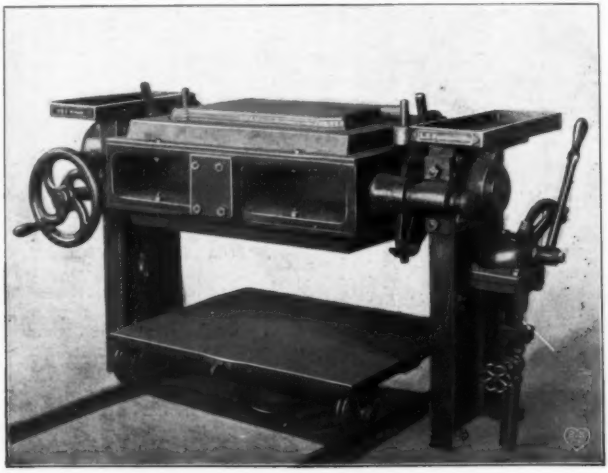

FIG. 1.

FIG. 2.

the pins, and can be removed by hand without employing any special care, such as would be necessary if mechanical lifting were not used.

In contrast to this method, in the turn-table machine the mould is drawn downward from the pattern on the piston after revolving the pattern-plate table.

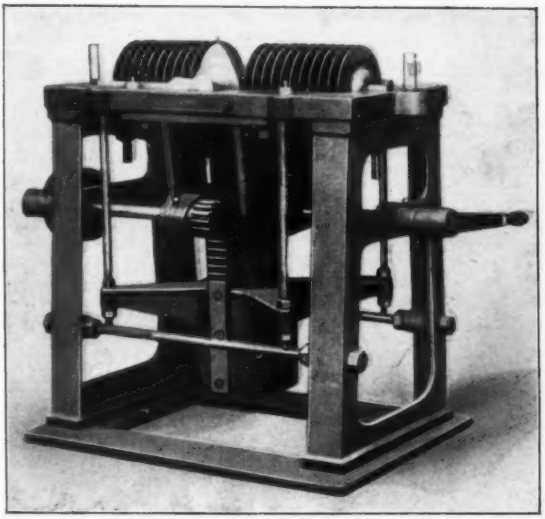

Fig. 3.

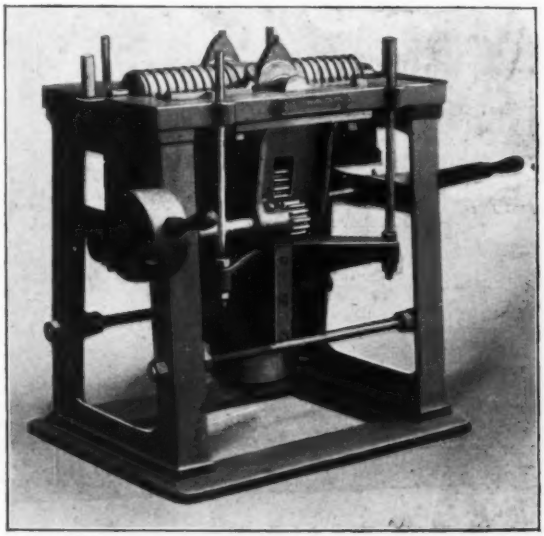

Fig. 4.

Two machines of this type are shown in Figs. 1 and 2. The first is built for boxes of ordinary depth. The two sides of the turntable carry both patterns, one on each side. The table is turned by means of a hand-wheel and worm, while the pattern is drawn by the hydraulic piston. Fig. 2 shows a similar machine, but for very deep castings, being used for moulding stove pedestals. In this machine also, the patterns are drawn by hydraulic pressure. Both machines are for hand-pressing, and hydraulic pressure is only employed for drawing. They are built without superstructure to facilitate working.

The machine with worm gearing is, naturally, somewhat more expensive in first cost, owing to the turntable arrangement, but this should not be of importance because the machine can be fitted with both the upper and the lower pattern-plates, allowing the boxes to be moulded alternately. If the machine has no turntable arrangement, it becomes necessary either to change the pattern plates after a certain time, or to employ two machines side by side. On the other hand, such a machine offers the advantage that patterns of any depth can be used upon it.

A feature of the stripping-plate machine is the sinking of the pattern through the pattern plate after the mould has been pressed, so that it is only separated from the pattern, and not from the pattern-plate; the separation from the latter is only done by lifting off the box from the machine.

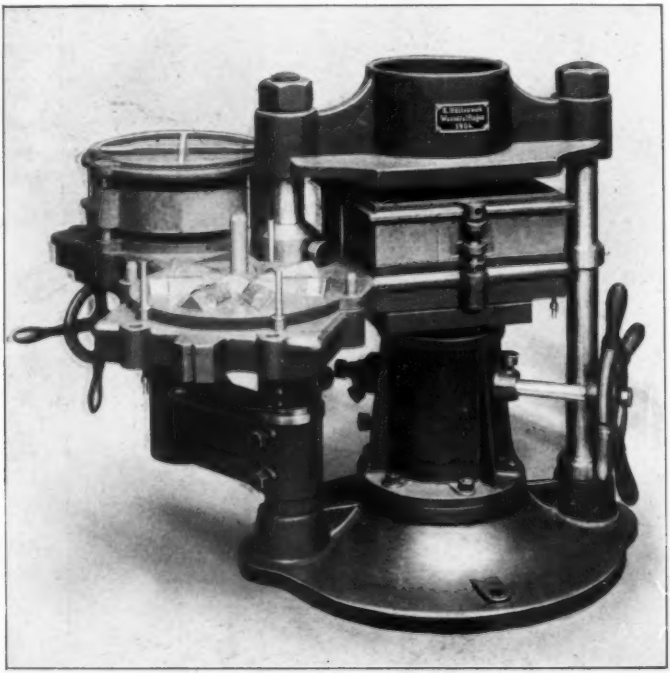

Fig. 5.

The stripping-plate machine is employed with advantage in cases of patterns with sharp and deep surfaces, and this advantage is, of course, to be found in the fact that it offers considerable support to the sand whilst the pattern is being stripped. A combination of the lifting and stripping appliances is useful when the pattern has only to be partly stripped, while the rest of it has to be separated from the mould by lifting the latter.

Figs. 3 and 4 show such a machine,

which is used for making small heating radiator pipes. The ribbed portion only is stripped, whilst the box is lifted by pins from the remainder of the pattern.

The next step in the development of the modern moulding machine was to press the sand mechanically in addition to drawing the pattern from the mould in a similar manner. From this dates the development of the moulding machine—properly speaking. It is built either for hand, hydraulic, or pneumatic power. On the Continent, compressed air has been little used, owing to the difficulty of obtaining a reliable installation on account of leakage, and the danger of explosions. The first cost of hydraulic power is also less than that of compressed air.

The hand-moulding machine has, of course, the great advantage that no outside power is needed, and that, therefore, no accessories or pipe work are required. In foundries, therefore, where only one or two machines are used, hand power may be confidently recommended.

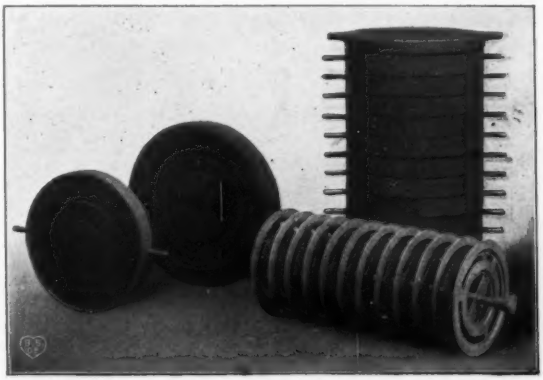

FIG. 6.

Since the development just described, the moulding machine has further progressed, and numerous types have been put on the market, culminating in the introduction of double-sided pressing and the revolving-table moulding machine.

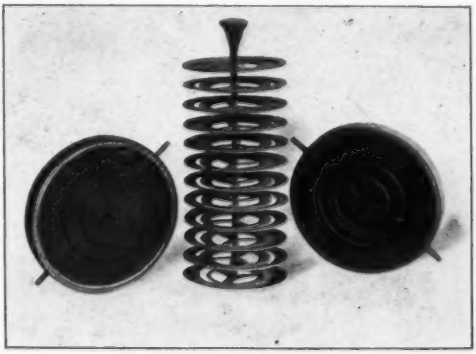

FIG. 7.

These two developments led to the manufacture of moulding machines of the types illustrated in the present article, but before describing these in detail it may be useful to make some general remarks about the work done by moulding machines, and thus to realise the ad-

vantages produced by using machine moulding in foundries.

The development of the moulding machine shows that inventors endeavoured, whilst cheapening the cost of labour, to obtain as clean and exact a casting as possible. The mechanical drawing of the pattern has produced the desired effect, while there is no danger of loosening the pattern from the mould by excessive or uneven rapping, which in the past often gave to similar castings a different weight. In machine moulding drawing not injuring the mould, there is no need of mending as in the case of hand-drawing.

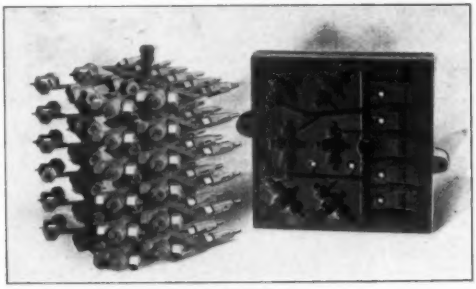

FIG. 8.

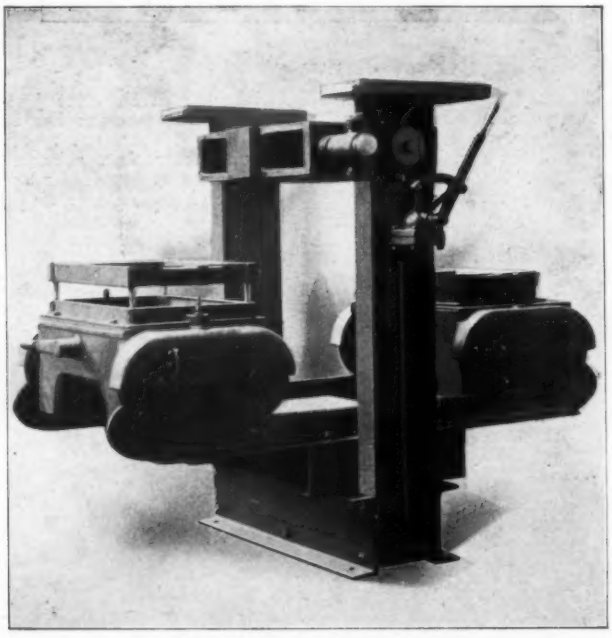

FIG. 9.

one mould, and consequently one casting, resembles another, while the machine

The increased output consequent upon the use of moulding machines follows naturally, but it is difficult to give definite comparative figures concerning it, because they must necessarily vary very considerably according to the object to be moulded. A moulding machine may, perhaps, produce in a few days the entire requirements of one casting for a year.

It follows that on the one hand a fairly large number of suitable patterns must be capable of being moulded on the same machine in order for the latter to work economically, whilst on the other hand, machine moulding requires larger storage room, because, in practice, the pattern plates are changed as rarely as possible, so that a large quantity of one casting is made at one and the same time. These patterns with their castings must then be stored. This drawback has been overcome by the revolving table machine illustrated in Fig. 5.

It need only be mentioned here that the revolving table has ball bearings, and takes three patterns for moulding at the same time, so that its simultaneous output includes three kinds of castings instead of one. The illustration further shows that the use of different shaped boxes on one and the same machine together is practicable, whilst a further considerable advantage consists in the following fact.

One man can work this machine advantageously, and produce more with it than by hand, but at a busy time, two, three, or more, workmen can be employed for handling it, and the output can be proportionately increased. It is claimed that this advantage is shared by no other machine, and is owing to the fact that the machine has three separate working places and thus admits of a division of labour without one workman hindering any other.

A moulding machine, whether worked by hand or hydraulic power guarantees an absolutely even ramming of the sand, which in turn leads us to machines with double-sided moulds. This method has revolutionised commercial foundry work, and, therefore, deserves detailed discussion. Before the double-sided mould was introduced, boxes were provided with an appliance for casting in series, and were then placed one over the other. Such a pile of boxes had consequently an aperture running from the top to the bottom box, so that all boxes were poured together. In doing this, however, the mould was only used on one side, so that for six moulds there were still twelve box parts needed, because we might say that only every other box contained a mould, whilst in between, the plain sides of the boxes joined one another. It was then de-

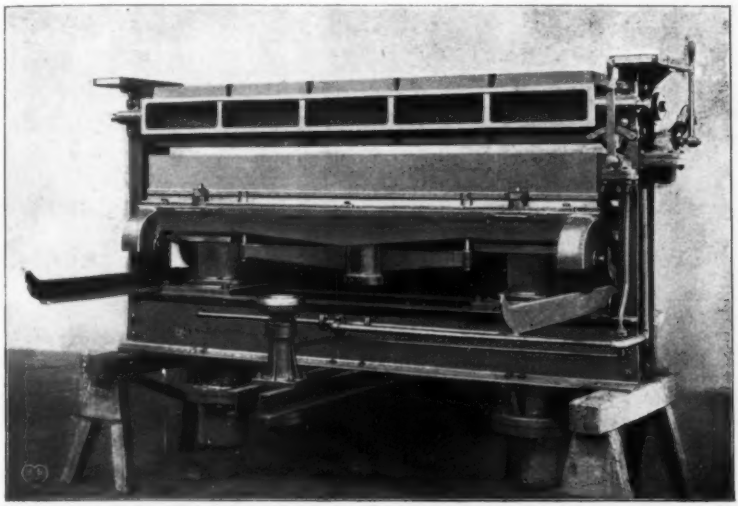

Fig. 10.

cided that the other side of the box could be used for moulds as well, and a machine of this type was designed for manufacturing the rings of cooking stoves. On the lower pattern plate a mould box is placed, the depth of which corresponds with the dimensions of the pattern, and on this box a pressing frame. The depth of this frame depends upon the depth of the box, and should be of such proportion that after the sand has been pressed it has the consistency required.

Fig. 11.

In order to do this, sufficient sand is first sifted into the box to cover the lower half of the pattern entirely. The box and the pressing frame are then filled with unsifted sand up to the top, and a small quantity of sifted sand is added at the finish. The upper pattern plate is then put into position, and fitting exactly into the pressing frame is guided by it during pressing. It is pressed to such an extent on the machine that the sand is compressed to the exact depth of the mould box. As the upper and lower pattern plate each contain a part of the pattern, a complete mould is found between each two boxes, when they are placed one on the top of the other, after being pressed on both sides. According to the depth of boxes, 7 to 13 of them are built up in one pile, that is to say, they are placed one on the top of the other, weighted according to the shape of the box, and are then poured together.

In Figs. 6, 7, and 8, are shown a number of multiple castings, together with double-sided pressed moulds. The principal advantages of multiple moulding may be summed up as follows: —

1. Saving of space by placing the moulds one on top of the other, whilst using both sides of the box.
2. Saving of sand as compared with the one-sided mould.
3. Saving of metal owing to the casting being done simultaneously.
4. Saving of wages, owing to the fact that each mould is used on both sides.

The machines illustrated below are certain types of machines already constructed,

and are merely shown to illustrate the variety of uses to which they can be put. They are either machines with lifting trucks or revolving table machines.

Fig. 9 shows a moulding machine with two lifting trucks on rails for double-sided pressing, each truck taking the lower pattern plate. The arrangement for drawing the pattern from the mould is shown on the left-hand truck. The turntable upon both sides of which the upper pattern plates have been fastened, serves as a counter-pressure plate.

When the box on either truck is pressed, its upper pattern plate is turned downwards, whilst simultaneously the pattern plate then on top is cleaned. The upper pattern is drawn by the descent of the truck on the piston. The illustration shows that different sizes of boxes may be simultaneously used on the two trucks, viz., in the illustration, boxes 12 in. by 16 in. and 15 in. by 22 in., and with this machine, with ordinary patterns, two men can easily make 200 to 220 moulds, and cast the same, in 10 hours.

A machine specially designed for making radiator pipes is shown in Fig. 10, on which the upper and lower portions of the mould are made with one pattern plate. Care should, however, be taken when moulding smaller sized pipes, of which there are two on one pattern plate, that these two patterns are fastened exactly equidistant from the centre. The boxes, owing to their size (94 in. by 11 in.), are provided with ribs, and are only pressed on one side, and the wooden pressure blocks on both sides of the turntable are arranged accordingly. Two such wooden blocks have been fitted because the machine is constructed to take two sizes of boxes. The mould is lifted from the pattern, as the illustration shows, by means of pins fastened to a cross piece fixed to the truck. When the truck, after being pressed hydraulically, is drawn back, it stands above the hydraulic pistons in the front of

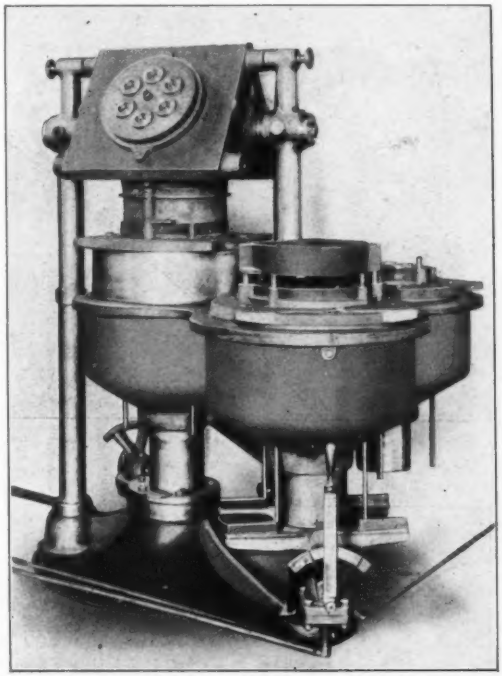

FIG. 12.

the machine, so that they can lift the cross piece upwards. The output of the machine with two men is 45 to 50 boxes moulded and cast in 10 hours, *i.e.*, 45 to 50 large or 90 to 100 small radiator pipes of about 6 ft. in length.

Fig. 11 shows a hydraulic machine of the revolving table type for double-sided pressing. The revolving table moves on ball bearings, and carries three lower pattern plates, while the three upper pattern plates are fastened on to a prism revolving horizontally round its axis. The illustration shows a pattern plate fastened

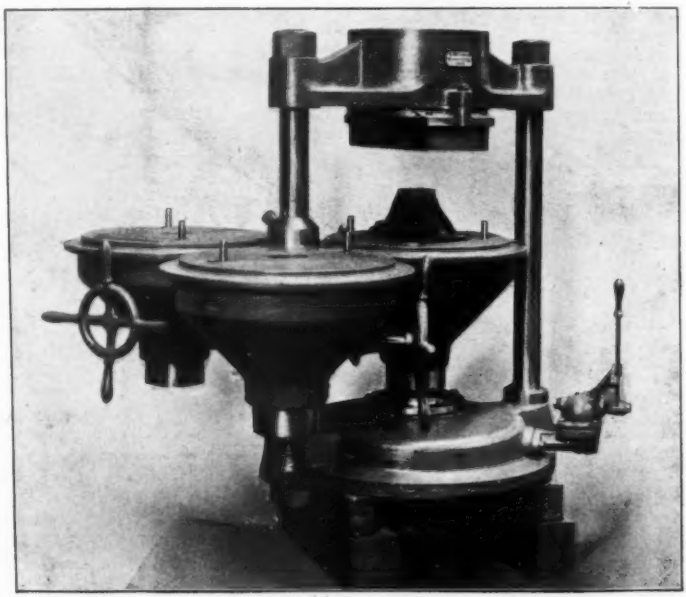

FIG. 13.

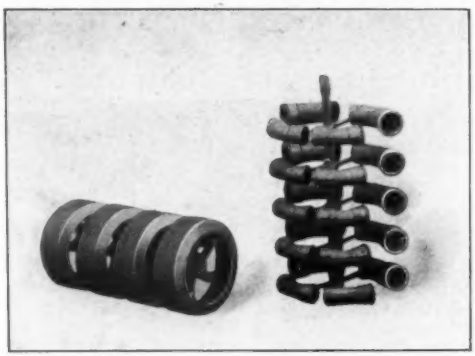

FIG. 15.

in this manner, whilst on the lower pattern plate the mould box, and above it its pressing frame, are placed. Each of the three parts of the revolving table has, besides the two bolts for fastening the pattern plates and boxes, four lifting pins worked by hand, as shown on the left of the illustration. When pressing, the whole revolving table is lifted, and, therefore, in this machine the drawing of the pattern cannot be done simultaneously with the pressing. This has been improved in Fig. 12.

In this machine the revolving table consists of four parts, viz., of three pressing tables placed within the fourth, this being the revolving table proper. On the left-hand side of the illustration, a table of this description has just been lifted by the hydraulic piston. The lifting cross is worked hydraulically by the appliance shown in front of the illustration. The box shown above this has just been lifted. The lifting cross shows the comparatively long grooves in which the lifting pins run. The construction has been made in this manner because, on the machine illustrated, boxes of varying sizes, either square (16 in. by 16 in.), or round (15 in. diameter) are used, and the position of the lifting pin is thus altered.

A comparison between the two machines last illustrated shows that the machine with single tables, Fig. 12, costs more, but has a greater output than that of Fig. 11, this having an output of about 200 boxes with two men in 10 hours, against 240 boxes for Fig. 12, under the same conditions.

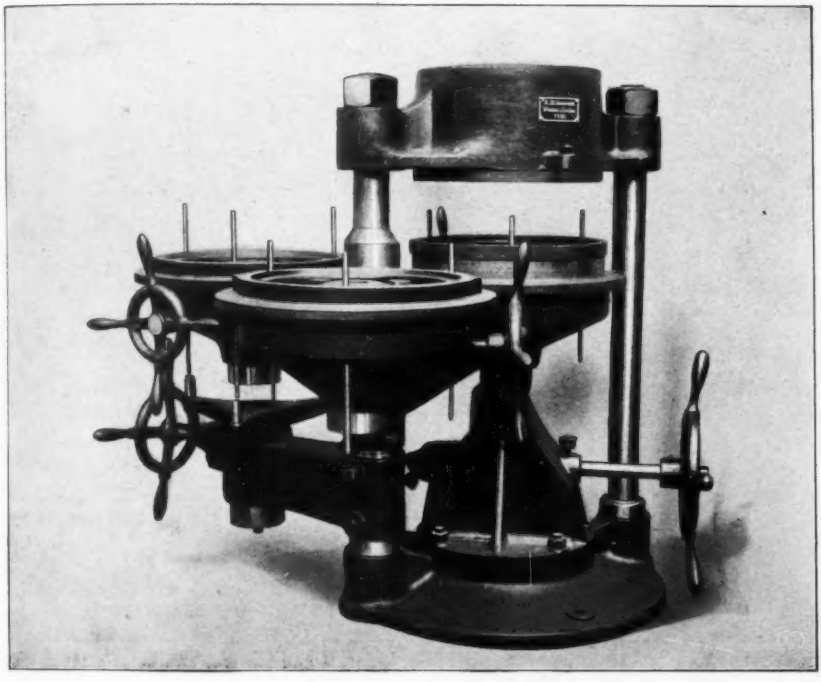

FIG. 14.

Fig. 13 shows a special machine for making rail chairs. The boxes are pressed on one side only, whilst the patterns are fastened as the illustration shows, on single pressing tables arranged for stripping plates, worked by means of the three-hand wheels shown on the revolving table. The pressure block screwed on to the pressure beam, has been hollowed

out in proportion to the depth of the pattern, in order to obtain a uniform pressing of the sand. As the pattern is entirely stripped, a lifting-off appliance is not needed on this machine. Its output was guaranteed for 200 rail chairs per day, but in practice, through extra men being employed, the machine produces 420.

Fig. 14 shows a machine combining the stripping and lifting appliances.

Fig. 15 shows on the left a pile of multiple castings moulded with this machine, viz., wheels for agricultural machinery, which had to be of an exact cylindrical shape, and, in consequence, moulded with stripping plates. Double-sided pressing was also required, as the foundry in question was very short of space, and required to save this as well as labour.

Fig. 16 shows a section through the pile of multiple boxes, in which it will be seen that shallow and deep boxes alternate. The shallow boxes may be said merely to contain a ring of sand, whilst between every two deep boxes there is a core separately moulded and placed in the middle. Thus, this process requires three separate moulds, and for this purpose the revolving table machine, with its three-parted tables, is perfectly adapted.

The machine illustrated in Fig. 14 has been built for hand pressing by means of the hand-wheel shown on the right of the illustration. On the left of the same the ordinary lifting appliance is shown, whilst each of the three parts of the table has its own hand-wheel for the stripping appliances. The revolving table is shown on the illustration with single pressing tables,

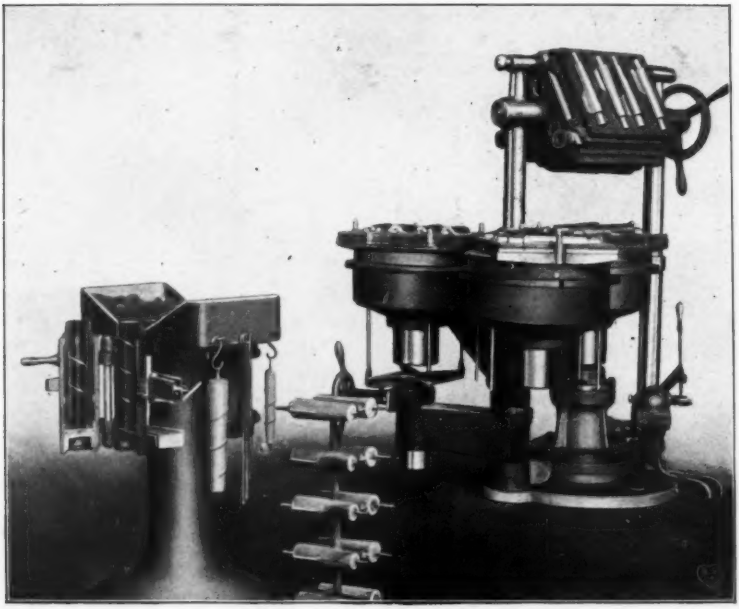

Fig. 17.

in which the cylindrical parts of the wheel are stripped whilst the boxes are lifted from the spoke and hub patterns. The output of the machine with two men in 10 hours amounts to 80 wheels moulded and cast.

A similar machine, without stripping plate appliances, is well suited to manufacture the fly wheels of sewing machines, with cast grooves.

For manufacturing the oil boxes of motor cars, the machine shown, Fig. 17, has been used. This is the revolving table machine with single pressing tables, and with a prism for the upper pattern plates. The

machine again shows that the revolving type is most advantageous for moulding three different patterns simultaneously. With this type, fifty pairs of pattern plates were provided, which were sufficient for several machines. One machine with two

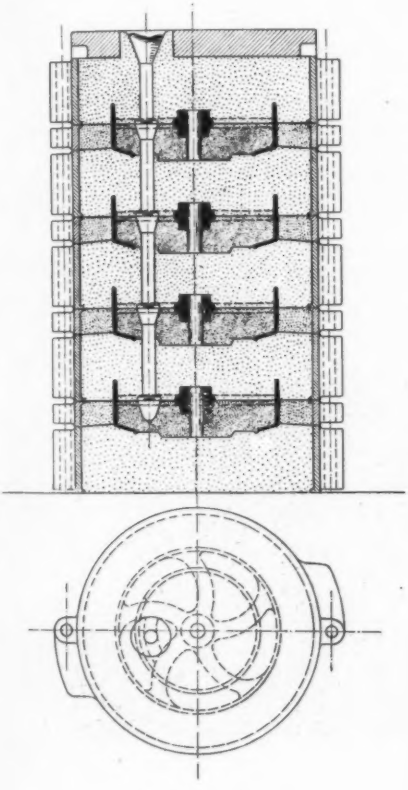

FIG. 16.

men produces in 10 hours about 150 moulds, equal to about 600 oil boxes moulded and cast. The core-making machine, with two movable, two-parted core boxes, is shown on the left, whilst between the two machines a multiple pile of cast oil boxes is seen.

The illustrations have been furnished to us by the Simplex Coke Oven and Engineering Company, Limited, of Temple Bar House, London, E.C., who are the sole representatives for these machines for Great Britain.

OBSERVATIONS ON SOME PHYSICAL CHARACTERISTICS OF CAST-IRON.*

By JAMES CHRISTIE.

CAST-IRON is probably the most complex, variable, and uncertain form in which iron is used. Not only is the content of extraneous metals and metalloids variable, but the condition in which the associated carbon exists, and the character of this association, are determined largely by the influence of silicon and possibly other metalloids. Again, the physical properties of the metal are influenced by casting temperature, rate of cooling, etc., so that altogether we can only predict the probable strength and stiffness of a casting in the most general way, and forecast results, which will suit an average, from which individual castings may vary widely in extremes. Grey iron of the foundry grades is alone considered here. The grading of the pig metal at the furnace has been, in the past, determined by the appearance of the fracture, but recently as much of the product is run in metal moulds, and appearance of fracture is deceptive, the tendency is to grade by chemical composition, the softer and weaker metals having the highest silicon and the lowest percentage of combined carbon. Taking three grades of foundry pig, and assuming that these are used for different classes of castings, say:

No. 1.—2.5 to 3 per cent. silicon for light castings.

No. 2.—2 to 2.5 per cent. silicon for medium-weight castings.

No. 3.—1.5 to 2 per cent. silicon for heavy-weight castings.

As a general average, all the grades will carry about 3.5 per cent. carbon, in total.

The recent specifications of the American Society for Testing Material require a transverse test on specimens $1\frac{1}{4}$ in. diameter and 12 in. between supports, load in the middle:

2,500 lbs. or over for light castings.

2,900 lbs. or over for medium castings.

3,300 lbs. or over for heavy castings.

with deflection before rupture not less than $\frac{1}{10}$ inch. Tensile strength of the aforesaid grades respectively to be not less than 18,000, 21,000 and 24,000 lbs. per square inch of section. While these standards are valuable in maintaining a high quality of product, yet they may imperfectly represent the resistance of the metals in actual service. We know that cast-iron is

* Paper read before the Engineer's Club of Philadelphia.

in extensive use that falls far short of these requirements. High tensile strength is frequently associated with brittleness, and is not always indicative of superiority.

For heavy machinery, etc., cast-iron is used in heavy masses, through which working stresses are imperfectly distributed, and probably is much softer and weaker in the middle of the mass, where it has cooled slowly, than at outer surfaces, where the metal has more rapidly cooled.

Furthermore, castings are usually under considerable internal strain, due to unequal contraction, and although this internal strain gradually disappears, it may have some disturbing influence after the casting has been put in service. It has been the practice of the writer to assume an ultimate tensile strength of 16,000 lbs. per square inch for ordinary iron castings, and to limit working stresses from 2,000 to 4,000 lbs. per square inch, according to the conditions and character of the service.

Cast-iron offers a high resistance to compressive stress, and although this resistance varies within wide limitations, it may be assumed as a working basis to be about six times that of the tensile strength, or, say, 95,000 lbs. per square inch of section.

Cast-iron is imperfectly elastic as compared to the superior forms of the metal. It presents no definable elastic limit, and exhibits marked permanent set, under low loads, either in tension or compression. Experiments continued for several years indicate that when loads exceeding one-half the ultimate are applied, failure eventually ensues. It may, therefore, be assumed to have a practical elastic limit in tension of about one-half the breaking load.

The coefficient of elasticity is likewise variable, in contradistinction to the constancy of the elasticity, under ordinary conditions, of wrought-iron and steel.

Recorded experiments indicate that the modulus of elasticity varies considerably in extreme cases, and is nearly alike in tension and compression. A modulus of 13,000,000 lbs. appears to be a fair valuation for direct tension and compression; or, for bending loads applied transversely, this modulus appears to average 16,000,000 lbs. when used in computation with the commonly accepted formula for flexure.

In the middle of the past century, as cast-iron became extensively applied to structural purposes, its physical properties were studied with great care, and the experiments of Hodgkinson and Fairbairn in England, and their contemporaries, yielded a fund of information on the subject. Seeking a section of beam which should exhibit the highest ultimate strength in proportion to area of cross-section, or of the weight of metal employed, Hodgkinson advocated a section in which the tension flange exceeded the compression flange about six to one in sectional area, the web usually tapering in thickness from the tension flange, diminishing toward the other flange. This form of beam was largely adopted, and took precedence as long as cast-iron was used for beams in structures. We find that the same method of reasoning influenced the machine designer in disposing cast-iron to seeming advantage in the construction of machines, massing the metal to resist tension, and permitting high unit stress on metal in compression; and especially is this observed in machines of the open jaw or gap type, such as presses, punching, and shearing machines, etc. The writer believes that usually the unit stresses should be little, if any, higher in compression than in tension, for the following reasons: In machinery rigidity or stiffness is usually the chief consideration; many machines do not fulfil the intended purpose properly, not by failure through fracture, but by a want of sufficient stiffness. Deflection has to be limited, and when that is done, breaking from excessive tension is sufficiently guarded. Remembering that cast-iron yields to compression, as much as with the same unit stresses it yields to tension, it follows that the compressive stress should not exceed the tensile strength per unit of section if it is desired to dispose a given mass of metal with least deflection. It is believed that rupture sometimes occurs in a machine apparently through tension, where the origin of the weakness could be traced to a want of material to sufficiently resist compression, the improperly supported tension side severing by cross-bending or transverse stress.

Taking for illustration an open gap machine with frame as illustrated in Fig. 1, tension at T and compression at C if the section is so shaped that compressive unit stress is six times that of the tensile unit stress, then, elastic moduli being equal, the frame will yield at C six times as much by compression as it does by tension at T. This permits an oscillation of the mass T around its centre. If this oscillation becomes dangerous, by extent or frequency, the frame will break by cross-bending at the mass T, giving the impression that more material is needed to resist tension, whereas the fact

may be that more material should be placed at C to prevent excessive yield by compression.

Owing to the peculiar physical characteristics of cast-iron, it has not been found practicable to harmonise experiments with the theory of flexure. It is therefore desirable for the designer to keep a record of experiments, and of failure of castings under known loadings, and from these results derive co-efficients, by means of which the strength and stiffness of various sections can be approximately known without recourse to the usual calculation for the resisting moments of the section.

In machinery the working stresses are usually impulsively or suddenly applied, sometimes with actual percussion or impact, and frequently alternate stresses of equal intensity in opposite directions

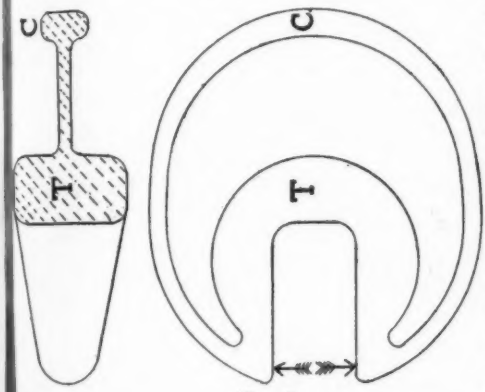

FIG. 1.

occur in rapid reciprocation. As it is known that a load so rapidly applied as to permit the unimpeded effect of gravity will produce a deflection double that due to the static effect of the same load, it can be seen that the total amplitude of vibration due to rapidly alternating loads must be very considerable. To prevent excessive vibration, the structure should be designed with a limitation of deflection in view, and the amount of this limitation is derived solely from experience, and should be governed largely by the nature of the service to which the material will be applied. For machinery under ordinary circumstances we might assume, in order to obtain satisfactory stiffness, that the deflection should not exceed $\frac{1}{1500}$ th part of the span, and under certain conditions, should be much less than this. Indeed, it is quite probable that a deflection in direct proportion to length is not advisable, but that the ratio of deflection to length should decrease as length is increased. For long members in compression, the sectional area must be augmented as the ratio of length to cross-section increases, but for members under variable tension alone, the section should be increased also, or the stress per unit of cross-section reduced, as the ratio of length to cross-sections increases, for the purpose of reducing vibration due to successive extensions. When rapidly alternating stresses occur, it is acknowledged that provision must be made for something more than the greatest stress in one direction alone. There are still differences of opinion and practice on this subject among bridge designers; some maintaining that when the alternations are of slow recurrence, so as to permit actual rest between reversals, no special increase of section is required; others specify that the sum of the sections required for the stresses in opposite directions should be used to suit the conditions. There can be little doubt that the latter estimate is little enough for machinery when the oscillation of the forces occurs with great rapidity, and especially when the metal under consideration is cast-iron, with a modulus of elasticity about one-half that of steel or wrought-iron. It is a safe general rule for ordinary cast-iron in machine structures to limit tensile stress to 4,000 lbs. per square inch of section, under the most favourable circumstances; to 3,000 lbs. when loads are suddenly applied; and to 2,000 lbs. when the force alternates in direction; these unit loads to be further limited to suit the ratio of length to section, as required for columns or any members in alternate extension or compression, or for beams or members subjected to alternating transverse stresses, the unit stresses on the material should be limited so that the sum of the deflections in opposite directions will not exceed $\frac{1}{1500}$ th part of the span, or such other limitation as, according to the judgment of the designer, will provide sufficient stiffness for the intended purpose.

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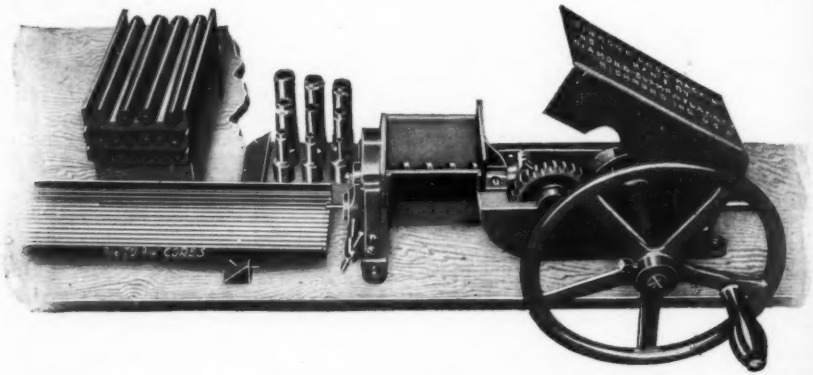
A DISSOLUTION of partnership has taken place between Messrs. F. Ashmore and W. T. Holt, brass founders, Birmingham, trading under the style of the Granville Brass Foundry Company.

THE DIAMOND CORE MACHINE.

The Diamond Core Machine is claimed to be the only machine on the market that will make cores as small as $\frac{3}{16}$ in. in diameter, 14 in. long, vented from end to end. Taking into consideration the price of metal when put into a casting, and the price after it is drilled out, and the time of drilling, brass foundries should find this to be a valuable machine. It is a new departure from the ordinary screw core machine, and is a combination screw and plunger machine. The screw is simply to convey the sand to the adjutator or swiper that puts the sand into the box, and the plunger moves it forward. The machine has a capacity of from 150 to



200 ft. per hour. Any shape core can be made on the machine up to $\frac{3}{4}$ in. in cross-section, square, oval, hexagon, flat, etc., and by using a mixture of charcoal and plumbago mixed with oil, cores as small as $\frac{1}{16}$ in. diameter can be made. Where work requires a smooth hole and to fit snug, such as hinges, charcoal cores are recommended, and also for holes that have to be tapped, as they leave no grit. The standard machine comprises a full set of round boxes, ranging from $\frac{3}{16}$ in., advancing by $\frac{1}{16}$ in. to $\frac{3}{4}$ in., making in all 10 different sizes of cores, also three cast iron core plates that will pile one on top of another, as shown in illustration.

This machine is being introduced by Messrs. J. W. Jackman & Company, Limited, of London, Manchester and Glasgow, and the machine is on show at their Manchester warehouse, 347, Chester Road, Cornbrook, Manchester.

LIST OF NEW INVENTIONS.

Specially compiled for THE FOUNDRY TRADE JOURNAL by MR. GEORGE BARKER, Fellow of the Chartered Institute of Patent Agents, Consulting Engineer and Chartered Patent Agent, 77, Colmore Row, BIRMINGHAM.

1907.

16,339. THE SAFETY TREAD SYNDICATE, LIMITED, and J. J. MCCLELLAND. Improvements in sand moulding machines.

16,746. E. A. CUSTER. Improvements in apparatus for casting metal pipes.

16,747. E. A. CUSTER. Improvements in apparatus for holding and pouring metal into moulds for casting operations.

16,748. E. A. CUSTER. Improvements in moulds for casting operations.

16,749. E. A. CUSTER. Improvements in art of casting pipes.

16,935. F. JACKSON. Improvements in or connected with air compressors and pumps.

18,588. J. BURROWS. Improved moulding machine.

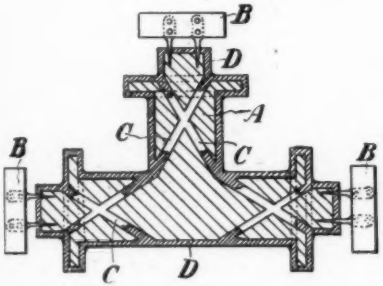
18,589. J. BURROWS. Improved balanced turnover table foundry moulding machine.

4,913. F. VALENTA, Bellinzona, Switzerland. Improvements in and in the production of casting patterns.

This invention relates to the production of casting patterns consisting of a metal envelope and a wooden core. The manner of producing the pattern is as follows:—

A temporary model, as shown at A in

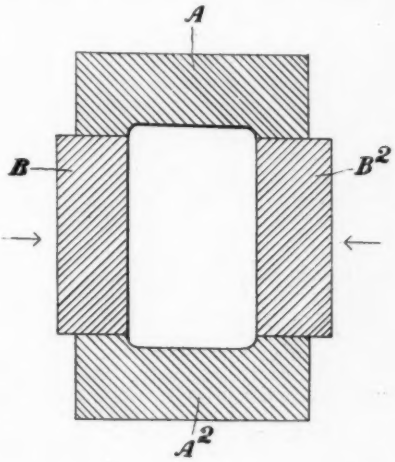
the figure, is prepared from cheap, soft wood, and is made to the size of the required casting. This model, which is held by iron supports B, which have been previously inserted in the model in suitable positions, is impressed in sand, according to the usual methods, and the mould, after taking out the model, is painted with cadmium. The model A is now reduced in size by removing from its entire surface a layer of from 2 m.m. to 5 m.m., and is provided at suitable positions with holes C and placed again in the same mould. The carrier irons B support the model A, so that a free space is formed between the latter, and the sand mould corresponding to the layer removed from the model. This space is now filled up by fluid metal, consisting of an alloy of tin and lead, in which operation the fluid



metal also penetrates into the holes C. After cooling, the metal surrounds the wooden model in the form of a layer D, which in consequence of the slow cooling of the metal in the holes is drawn close to the wooden model. The metal in the holes also serves, after cooling, to stiffen the pattern. The carrier irons may now be removed, and the holes left in the layer can be filled with tin. Instead of tin and lead for the metal coating other alloys may be used. A pattern prepared in this manner has, on the one hand, the advantages of an iron pattern, consisting of great durability, clean casts, fireproof qualities, etc., while it has at the same time the advantages of a wooden pattern in its low weight, and, consequently, more convenient handling, combined with cheaper production.

7,196. Improvements in ingot moulds. S. J. Robinson, and G. Rodger, Sheffield.

The object of this invention is to simplify the construction of ingot moulds which are for use in compressing machines. The figure shows a transverse section of a mould constructed in accordance with this invention. The parts A and A^2 are stationary sides of the mould which may be supported in a position by any suitable means, such as by bolts, wedges, or springs so as to enclose a space to receive the molten material. The sides A and A^2 may be flat, or shaped to



any suitable curvature according to the desired form of ingot. The sides B and B^2 are capable of being moved towards or from each other by the application of pressure, and thus permit of the ingot being compressed while cooling.

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CORRESPONDENCE.

"THE FOUNDRYMAN, PAST, PRESENT, AND FUTURE."

To the Editor of the Foundry Trade Journal.

Sir,—While agreeing with the general tenor of the paper read by Mr. Sherburn at the recent convention of the British Foundrymen's Association, held at Sheffield, and the spirit of the discussion which followed, I cannot refrain from asking myself the question if all this is really sincere. No allusion seems to have been made by the author, nor by any of the members of the Association who took part in the discussion, to the question of the appointment from the

ranks of foundrymen, for service on the Staff of Admiralty inspectors, positions they have hitherto had no hope of reaching.

In connection with this matter one might point out the circumstances attending the defective rudder casting for H.M.S. "King Edward, VII" as an instance of the necessity there is for the appointment of moulders to the position of inspectors for the Admiralty. I would suggest that the Association communicate to Mr. Courthope, M.P., and his colleagues, the thanks of the Association for the effort they put forth, at the fag-end of the last session of Parliament, to have moulders placed on these staffs.

If this suggestion be not practicable at present, perhaps it may bear fruit for future action in this direction, but how such a matter escaped both author and all others who took part in the discussion on Mr. Sherburn's paper cannot but be a matter of some surprise to more than the writer. However, we shall put it down to inadvertency and trust for better things in the future.

Those of us whose day is likely to be for ever gone for Admiralty appointments, can the more unflinchingly seek for others what has hitherto been denied us. And, as the day is for the young men of the next generation, let us shew by our earnestness the truth of our convictions by doing what we can to hurry on the time when moulders will at last command the attention of the powers that be, of their fitness for the position of some of the appointments on the Staff of Admiralty inspectors.

If the Association moves in this direction, it will show by its deeds, that the members are in dead earnest about the intellectual and social improvement of the foundryman's position. By this the future will inevitably put him on a level with the social and intellectual status of mechanics in general.

Thanking you in anticipation,

I remain, yours sincerely,

W. R.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Would any of the readers of your valuable paper give their opinion as to the best mode of transmitting air or blast to the cupola with the object of bringing down the metal hot, with minimum of coke, and in the shortest time?

Yours, etc.,

"SUBSCRIBER."

THE EARLY HISTORY OF IRON FOUNDING.*

BY ROBERT BUCHANAN.

A FEW years ago, when visiting the Antiquarian Museum in Edinburgh, I was shown numerous articles of stone and bronze, most of them for use in battle. "When, in the world's history," I asked, "was the Stone Age?" The attendant replied that the present was the Stone Age. As I looked surprised at the statement, the courteous attendant showed me a case of stone battle axes, hammers, and maces recently received from the South Sea Islands, as proof of his statement. Forty years ago the Assiniboine Indians of Canada cooked their buffalo meat by immersing it in water in a buffalo hide held up at the corners, throwing into the water stones which had been made red-hot. This latter fact can scarcely be cited as proving that the Red Indian was still in the Stone Age, but only that he had not reached the Age of Iron.

My friend of the Museum assured me that in the world as a whole there are no definite periods of time which we may call Ages of Stone, Bronze, or Iron, though for certain countries of the world such definitions may be correctly applied. A little reflection will show that this view is the correct one.

So we find, when we come to consider the founding of metals, that we are but the lately-added links of a chain which connects us with the realities of a dim antiquity.

We read of the great pillars, 27 ft. long by 5 ft. 9 in. outside diameter, which Hiram, of Tyre, cast, and of the great molten sea 15 ft. from brim to brim, and a hand-breadth thick. Also of the ten wonderful bases with four wheels under each, "and the work of the wheels was like the work of a chariot wheel, their axle-trees, and their naves, and their felloes, and their spokes were all molten."

The great pillars may have been made without patterns or models, but that is improbable. It is certain that the bases mentioned were made from patterns or models, for we are told that "after this manner he made the ten bases; all of them had one casting, one measure, and one size." (I. Kings, Chap. 7.)

The art of patternmaking as well as of founding is thus very ancient. How

* From a Presidential Address to the members of the South Staffordshire Iron and Steel Institute.

such great quantities of molten bronze were melted and handled we have no knowledge. Not improbably it was by the method Krupp used in casting a 100-ton steel ingot, namely, by having a small army of men, and casting from crucibles.

Earlier in Jewish history we are told that Goliath of Gath went into battle with a helmet of brass upon his head, brass greaves upon his legs, on his body a brass coat-of-mail weighing 156 lbs., and in his hand a spear the head of which was iron, and weighed between 18 and 19 lbs. In addition, he had a target of brass between his shoulders. Mention is made in the Book of Joshua of the vessels of brass and of iron captured at the taking of Jericho, and the Prophet Isaiah says, "Who hath formed a god, or molten a graven image; that is profitable for nothing."

In these early times then, the brass-founder's art had existed long enough to have reached a very high stage of development.

It is to be noted that the brass mentioned in all old writings is what we now know as bronze; an alloy of copper and tin. What we now know as brass is an alloy of copper and zinc, and was first used hundreds of years after the times of which I have been speaking. The same applies to the casting of iron, as it was only within comparatively recent times that what we now know as cast iron was discovered.

To come nearer home, it may be noted that the Highlands of Scotland had no Bronze Age, but passed directly from the Stone to the Iron Age. Ireland had a great Bronze Age, and in Ireland have been found the finest examples of ancient bronze work we possess. In Ireland was found a sandstone mould, containing a bronze spear-head, with the runner head and "git" attached, the mould divided exactly as we would divide a chill mould to-day. This sandstone mould and bronze casting I have seen and examined.

It is remarkable that the production and utilisation of cast iron came very late in the life history of metals. Iron and steel had been produced directly from iron ores thousands of years before cast iron comes into notice as a metal of utility. It is very probable that cast iron had often been made accidentally before its utility was perceived.

The first time that cast iron came into prominence in England was in 1543, in the reign of Henry the Eighth, when Ralph Hogge, at Bucksteed, in Sussex, made a cast-iron cannon. Probably this was cast directly from the blast furnace.

Hogge had as an assistant Peter Baude, a Frenchman, whom he had brought from France to show him improved methods of founding. This shows that the founding of cast iron had been in considerable use on the Continent of Europe, at least so far as France is concerned. Baude evidently began business on his own account as a maker of cast-iron cannon, for we are told that John Johnson, a "covenanted servant" of Baude's, exceeded his master "in his art of casting ordnance, making them cleaner and to better perfection." Thomas Johnson, son of John Johnson, and mentioned as being a "special workman" in and before the year 1595, cast for the Earl of Cumberland 42 "great pieces of ordnance," each weighing 6,000 lbs. Fairbairn hazards the opinion that the change from the "blast bloomery" to the blast furnace took place early in the sixteenth century. I think it very improbable that the change was so late as that. Were the first blast furnace installed in the year 1501 it is most improbable that the art of casting iron had progressed so rapidly as to admit of the casting of cannon only 42 years later.

The Sovereigns of England owned two blast furnaces in the Forest of Dean, these being erected about the year 1550, in the reign of King Edward the Sixth. By the time Elizabeth was on the throne the English founders had evidently outdistanced their rivals in the excellence of their cannon, as there was a considerable export trade to the Continent in these engines of war.

In the reign of James the First there was a great crisis in the iron trade. An enactment was made forbidding the cutting of timber for the purpose of making charcoal for use in ironworks, the forests in Sussex being alone exempt.

At the time this Act was passed the annual output of iron in Britain was 180,000 tons, a very considerable amount.

The scarcity of wood to make charcoal caused the making of iron to be so increasingly difficult that by the year 1740 the output had dropped to the paltry amount of 17,350 tons per annum. There must have been a relaxation of the law forbidding the use of wood for the making of charcoal, for we find that charcoal iron was being made in South Staffordshire prior to the year 1619, and up to the year 1646, when the Civil War began.

In the year 1619 Dud Dudley, one of the great pioneers of iron manufacture, and one of the most pathetic figures in English industrial life, by the influence of his father obtained from King James a patent to make iron by a new method. Dud Dudley was a natural son of one of the Earls of Dudley, and was born in the town which bears his name. His patent was declared to be related to "the mistere and arte of melting iron ewre (ore), and of making the same into cast workes or bars, with sea coles, or pit coles, in furnaces with bellowes." He made the pig-iron at Pensnett, and refined it "into merchantable good bar iron" at Cradley Forges.

He goes on to say, "I also made all sorts of cast-iron wares, as brewing cysterns, pots, morters, and better and cheaper than any yet were made in these nations, with charcoles."

By a combination of ironmasters interested in the making of charcoal iron he got put out of his works at Pensnett and Cradley, but began again to make pig-iron from "pitcoles," at the Himley Furnaces. Not having a forge, and the necessary refining furnaces for treating the pig-iron for the production of bar-iron, he was under the necessity of selling his pig-iron to the charcoal ironmasters. We need not be surprised to receive Dudley's complaint of these ironmasters not only "detaining his stock, but also disparaging the iron." The charcoal ironmasters by some means got the Himley Furnace into their hands, and Dudley built a new, large furnace near Sedgley. This furnace was 27 ft. square, and was built of stone. What the height was we do not know. The bellows to blow the furnace, Dudley says, "were larger than ordinary bellowes are, in which work he made 7 tuns of iron per week, the greatest quantity of pit-cole iron that ever yet was made in Great Britain." Then he goes on to tell of how "the author was thrown out of his works, and the bellowes of his new furnace and invention by riotous persons cut in pieces, to his no small prejudice and loss of his invention of making iron with pit-cole, sea-cole, etc."

Dudley was acquainted with the three varieties of pig-iron, though we may differ from some of his conclusions.

"Give me leave to mention that there be three sorts of cast iron. (1) The first sort is grey iron. (2) The second sort is motley iron, of which one part of the sowes, or piggs, is gray, the other part is white intermixt. (3) The third sort is called white iron; this is almost as white as bell-mettle, but in the furnace is least fined and the most terrestrial." (Evidently meaning impure.) "Of the three, the motley iron is somewhat more fined, but the grey iron is most fined and more sufficient to make bar-iron with, and tough iron to make ordnance, or any cast vessels, being it is more fined in the furnace, and more malleable and tough than the other two sorts before mentioned."

He mentions selling many "tuns of pigg or cast iron" at £4 per "tun" with good profit, when "charcole pig-iron hath been sold at £6 per tun, yea, at seven pounds per tun."

He sold bar iron at £12 per "tun" when charcoal iron was selling at from £15 to £18 per ton. Dudley mentions the millions of tons of slag and cinder available, the product of many years of working the "bloomery" furnaces, some of which was being used at the pig-iron furnaces, and was found to be easier of fusion than was the iron ore. The charcoal furnaces made from two to three tons of "pigg" or cast iron in 24 hours, but Dudley expresses his contentment with one ton in 24 hours, "which once he attained before his bellowes were riotously cut."

Dudley's claim for the patent granted to him by King James the First does not disclose what his method or secret was, but Dr. Percy says that probably it was by coking the coal before using it. Dudley received from Charles the First, in the face of much opposition, a second patent for a term of 14 years.

On the outbreak of the Civil War, Dudley joined the army of King Charles as an officer, and was involved in the general ruin of the King's party. In the Forest of Dean some officers, friends of Cromwell, endeavoured to make iron in "potts of glasshouse clay," but failed. They endeavoured to get Dudley to advise them, but he contented himself by predicting that they would not succeed. One final glimpse we get of this great Englishman. After the Restoration he petitioned Charles the Second for a renewal of his patent, but his first petition was lost. To his second petition he got no reply from the Royal founder of the "Royal Society," and Dud Dudley's life went out, as did his furnaces, in a gloom of apparently utter and complete failure. With a period of 250 years to bridge, it is difficult to know the whole man, but to me his is a character most fascinating. He saw the country over-

run by lawless and sturdy beggars, for employment was scarce, and the iron trade declining owing to the completed destruction of the forests and consequent scarcity of charcoal. His declared intention was to build up again the iron trade of England by the use in iron-making of the small coal which was being thrown aside as waste materials at the collieries. It was reserved for one of a later generation, living in happier times, and under more favourable conditions, to succeed where he failed. A study of the life of Dud Dudley, however, leaves us with the knowledge that early in the seventeenth century, in South Staffordshire, a great man was born. He lived and worked, triumphed and failed, fought and suffered, and exhibited through all an invention, perseverance, patriotism, and fortitude which compel our admiration.

The First Cast Iron Cooking Pot.

In the year 1709 Abraham Darby, a native of Birmingham, was in charge of a brass foundry in Bristol. For hundreds of years the Dutch have been famous as bell-founders, and it was from Holland that Darby obtained his skilled men. Abraham Darby conceived the idea of casting cooking pots of iron, and set his brass founders to do so, but they failed. Possibly they did not want to succeed. With the assistance of a Welsh boy, John Thomas, Darby himself managed to cast a pot successfully. The pot was cast in a wooden moulding box; probably these were in regular use for brass-founding at that period. The iron was almost certainly, melted in a crucible, with charcoal as fuel, the coking of coal not yet being known. The secret of how to make cast-iron pots was kept by Darby and Thomas and their successors for over one hundred years. Dr. Percy was told by a lady member of the Darby family, living about sixty years ago, that the secret consisted of using fine sand, and venting the sand thoroughly for the passages of the gases liberated when the iron was poured. As brass-founders now use a closer and finer sand than do ironfounders, the explanation is, I think, inadequate. Until the coking of coal was accomplished probably the melting of the iron was the greatest difficulty.

It is worthy of note that betwixt the first instance of a cast-iron cannon being made in England, and the first cast-iron cooking pot, there was a period of 166 years.

The Evolution of the Foundry Cupola.

In the Stückofen, or High Bloomery, wrought-iron was made, but by allowing the bottom to wear deeper, thus forming a well below the single tuyere, and using more fuel and charging the furnace higher, cast iron was produced. The slag was not drawn off, but was retained to keep the oxygen of the blast from decarburising the iron. When the furnace was so used, it was known as a Blauofen furnace. Percy says, "Hence nothing could be more gradual than the development of the modern blast furnace in which cast-iron alone is obtained." Again he says, "When blast furnaces are built slightly of brick only, and hooped or cased with iron, they are called cupola furnaces, to distinguish them from massive furnaces like those of Congreaves." The foundry cupola is thus very closely related to the blast furnace as first developed from the Blauofen furnace. It differs only in minor details, and here and there cupolas may be found having only one tuyere, and again there may be as many as 16, but in every case the cupola is used for the melting of iron, and not for the reduction of ores.

The proper working of cupolas is a subject which is receiving from foundrymen in general a considerable amount of attention, but there are still considerable numbers of them who have the haziest ideas as to what is taking place as melting proceeds. In this respect, however, as in the science and practice of foundry work, the British Foundrymen's Association is doing a good and useful work which is certain to have the effect of raising the progressive foundryman to a higher plane of knowledge and practice.

(To be continued.)

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THE gross value of the estate of the late Mr. T. W. P. Storey, one of the proprietors of the Mostyn Iron Works, is £98,083.

MR. J. HOLDEN has resigned the post of locomotive superintendent on the Great Eastern Railway, and is to be succeeded by his son, Mr. S. D. Holden.

MR. S. B. HASLAM, of Messrs. Haslam & Shantheil, engineers, Cardiff, was recently married to Miss E. M. Riches, youngest daughter of Mr. T. H. Riches, J.P.

TRADE TALK.

MR. J. J. KELLY, iron and brass-founder, of Barnsley, has been adjudged bankrupt.

MR. W. FOX, general engineer, trading founder, of Barnsley, has been adjudged bankrupt.

MESSRS MOWLE & MEACOCK, Egerton Iron Works, Chester, have decided to retire from business.

THERMIT, LIMITED, have opened at 210A, Bow Road, London, E., a fully-equipped repair shop.

MESSRS. W. J. CRAWFORD and E. Draper, engineers, Sheffield, notify a dissolution of partnership.

MESSRS. G. LEES and R. R. TAYLOR, engineers and iron founders, Hartlepool, have dissolved partnership.

MESSRS. MAWHOOD BROTHERS, edge tool makers, Sheffield, have converted their business into a limited company.

THE LILLESHALL COMPANY, LIMITED, have removed their London offices to Royal London House, Finsbury Square, E.C.

A SERIOUS fire occurred on the premises of the Machine Tool Company, Limited, Nottingham, recently, doing considerable damage.

MR. G. ROSENBUSCH, Queen Anne's Mansions, London, S.W., has established himself in business as a consulting engineer.

MESSRS. W. PURDEN, T. CROSS, and J. CASH, of Tipton, trading as the Denbigh Engineering Company, have dissolved partnership.

MESSRS. J. WOOD AND J. ROBBINS, general ironfounders, Tipton, trading as Henry Whitehouse & Company, have dissolved partnership.

G. C. MILNES, VOSS & COMPANY, LIMITED, Birkenhead, have appointed Mr. G. F. Milnes, 62, London Wall, E.C., as their London agent.

THE engineering staff of the Clyde Navigation Trustees have been busily engaged shifting their plant from their old workshops at Dalmuir to their new workshops at Renfrew.

THE SHELTON IRON, STEEL AND COAL COMPANY, LIMITED, of Stoke-on-Trent, are opening offices in Birmingham, at 63 and 64, Exchange Buildings.

MESSRS. C. P. AND H. C. SPARKS have established themselves in business at 49 to 51, Moorgate Court, Moorgate Street, E.C., as consulting engineers.

NEGOTIATIONS have lately been proceeding for the amalgamation of the National Gas Engine Company, Limited, with Crossley Brothers, Limited.

THE GENERAL ELECTRIC COMPANY, LIMITED, have acquired the patents of the "Osram" electric lamp for Great Britain and the British Colonies.

THE BRITISH MANNESMAN TUBE COMPANY, LIMITED, have removed their head offices from 110, Cannon Street, E.C., to Salisbury House, London Wall, E.C.

SIR W. G. ARMSTRONG, WHITWORTH & COMPANY, LIMITED, have appointed Mr. G. Blair, 38, Queen Street, Glasgow, as their sole representative in Scotland.

THERE has been a dissolution of partnership between Messrs. L. H. Bendall and A. M. Bendall, engineers and iron-founders, Lawford, near Manningtree, Essex.

MAVOR & COULSON, LIMITED, of Glasgow, have appointed Mr. F. H. Preece, 27, Clement's Lane, E.C., as their representative for London and the Southern District.

THE BRIGHTSIDE FOUNDRY AND ENGINEERING COMPANY, LIMITED, of Sheffield, recently cast two very large iron moulds for armour plate ingots, each weighing 90 tons.

A DISSOLUTION of partnership is notified in connection with Messrs. A. Harvey and W. A. Maas, general engineers, Finsbury Parade, Finsbury Road, Wood Green, N.

THE TREDEGAR IRON AND COAL COMPANY, LIMITED, and Palmer's Shipbuilding and Iron Company, Limited, have removed their London offices to 60, Fenchurch Street, E.C.

WM. GLOVER & SONS, LIMITED, have decided to give up the structural and general engineering branch of their business as carried on at the Packmore Works, Warwick.

MESSRS. V. H. COATES & COMPANY, who have been appointed agents for Victor Coates & Company, Limited, Belfast, have opened an office at 2, Norfolk Street, Strand, London.

THE YORKSHIRE ENGINE COMPANY, LIMITED, of Sheffield, have appointed Messrs. Brydon & Company, 19, Victoria

Buildings, Victoria Street, Manchester, as their Lancashire agents.

Mr. E. Brand, 35, Shakespeare Street, Manchester, has been appointed general agent for Great Britain for Mr. J. G. Kayser, Engineering Works, Nuremberg-Glaisainmer, Germany.

Messrs. A. C. Potter, R. W. Bennett, and H. J. Reeves, general engineers, Lant Street, Southwark, London, S.E., have dissolved partnership so far as regards Mr. R. W. Bennett.

Mawdsleys, Limited, Zone Works, Dursley, Gloucester, have appointed Messrs. D. M. Malloch & Company, 50, Wellington Street, Glasgow, as their agents for the West of Scotland.

Mr. R. Hopkinson, lately connected with J. Hopkinson & Company, Limited, Huddersfield, has secured works at Huddersfield, where he proposes to carry on the manufacture of gas and oil engines, etc.

Norton & Gregory, Limited, Castle Lane, Buckingham Gate, London, S.W., have purchased the business of the Architects' and Engineers' Supply Association, 4 and 5, Dean Street, High Holborn, London, W.C.

The public examination took place in London recently of Mr. F. W. Jenkins, engineer, Queen Anne's Chambers, Westminster, London, S.W. The statement of affairs showed liabilities amounting to £11,454 12s. 9d., and no assets.

The control of the Redbourn Hill Iron Works, Frodingham, Lincs., has been relinquished by Monks, Hall & Company, Limited, of Warrington, in favour of the directorate of the Cwmfelin Steel and Tinplate Company, Limited, Swansea.

A. Ransome & Company, Limited, engineers and iron founders, Stanley Works, Newark-on-Trent, the Sturtevant Engineering Company, Limited, and Mr. W. E. Oakley, Oakley Steel Works, Trafford Park, Manchester, have been elected members of the British Chamber of Commerce in Paris.

John Brown & Company, Limited, the builders of the turbines for the "Lusitania," acquired a licence from Willans & Robinson, Limited, to enable them to use the special method of building up the blades in sections, which forms so important a feature of the Willans-Parsons turbine.

The statutory meetings of the creditors and shareholders of Joseph Richmond & Company, Limited, New Sun Iron Works, London and Cirencester, were held recently. The accounts showed total liabilities £10,432, of which £5,959 was expected to rank for dividend, against assets valued at £12,491.

Swan, Hunter & Wigham Richardson, Limited, were awarded the Grand Prix for their exhibits at the recent Bordeaux International Exhibition, while the British Westinghouse Electric and Manufacturing Company, Limited, received a gold medal at the Christchurch Exhibition for the best 25 b.h.p. gas engine in the show.

There is a heavy aggregate of orders for turbine machinery in course of execution in this country. Twelve coastal destroyers under order are to have turbine engines, and it is believed that at least one of the Brazilian battleships to be built in this country, and the two Argentine gunboats are to be propelled by turbine machinery.

The Engineering Standards Committee has published a report on British standard systems for limit gauges for screw threads (Publication 38). It deals only with the limits which the Committee recommend for British standard screw threads from ¼ in. to 3 in. diameter inclusive, in order to secure interchangeability and the degree of accuracy of fit which is practicable in ordinary work.

The plant at Neath Abbey Iron Works—once world-famed—was sold by public auction at Neath recently. Flooring plates realised 50s. a ton; cast-iron foundry boxes up to 51s. 8d.; chills, 45s.; wrought and cast scrap generally fetched an average of about 48s. to 50s.; brass, 7½d.; lathes, £21, £28, and £15 10s. A slotting machine went for £11; drilling machine, £14 10s.; planers, £17 10s. to £21, whilst engines and other machines fetched satisfactory prices.

Amongst the exhibitors at the Engineering and Machinery Exhibition, which opened at Olympia on September 19, are A. Haworth & Sons, Sowerby Bridge; Greenwood & Batley, Limited, Leeds; George Cradock & Company, Wakefield; W. Summerscales & Sons, Limited, Keighley; McPhail & Simpson's, Wakefield; J. Hopkinson & Company, Limited, Huddersfield; Craig & Donald, Limited, Glasgow; Dobbie M'Innes, Limited, Glasgow; John Lang & Sons, Glasgow; Macdonald, Adamson, Swinburne & Company, Limited, Glasgow; L. Sterne & Company, Limited, Glasgow; and Glenfield & Kennedy, Kilmarnock.

PERSONAL.

MR. F. B. OLLIS has been appointed manager of the constructive department at Chatham Dockyard.

PROFESSOR C. H. BENJAMIN has been appointed Dean of the Schools of Engineering of Purdue University.

THE gross value of the estate of the late Mr. H. Batty, one of the directors of Hornsby & Sons, Limited, is £4,002.

THE late Mr. J. Rhodes, of Messrs. Joseph Rhodes & Sons, Hope Foundry, Morley, left estate of the gross value of £23,428.

MR. W. DOBSON, a director of the Wallsend Slipway and Engineering Company, Limited, left estate entered at £124,433.

MR. T. C. EASTWOOD, chairman of Eastwood, Swingler & Company, Limited, ironfounders, has been made a J.P. for Derby.

MR. G. R. CALLANDER has secured an appointment on the London staff of the Stirling Boiler Company, Limited, 25, Victoria Street, S.W.

THE late Mr. J. A. Hodgson, a director of Messrs. S. H. Burrows & Sons, Limited, South Yorkshire Iron Works, left estate valued at £17,963 gross.

MR. W. L. MADGEN has been appointed vice-chairman, Mr. B. Broadhurst and Mr. J. J. Steinitz joint general managers and Mr. F. M. Hodson secretary and chief accountant, of the Brush Electrical Engineering Company, Limited.

MR. CHARLES D. PHILLIPS, Emlyn Engineering Works, Brass and Iron Foundry, Gloucester, was recently the recipient of a presentation from his employés, "as a mark of esteem and appreciation of him as an employer."

MR. A. N. SYMINGTON, one of the directors of the Derwent Foundry Company, of Derby, has been the recipient of a presentation from the workmen, as a token of respect, on the occasion of his departure to take up his residence near London.

IN MR. J. E. H. ALLBUT the British Foundrymen's Association have an able new secretary, and his appointment, as was evidenced at the annual meeting of the Association in Sheffield, was generally welcomed. Mr. Allbut has already put himself completely *au fait* with the secretarial duties of the Association at the offices in Chesterfield.

NEW COMPANIES.

F. E. ADAMS PRESSURE TOOL COMPANY, LIMITED.—Capital £5,000, in £1 shares.

MAGNETIC CLUTCHES, LIMITED.—Capital £20,000, in £1 shares.

BRITISH CHILLED ROLL AND ENGINEERING COMPANY, LIMITED.—Capital £30,000, in £1 shares.

NORTH BRITISH STEEL FOUNDRY, LIMITED.—Capital £20,000. Registered office: Balbardie Steel Works, Bathgate.

TUCKINGMILL FOUNDRY COMPANY, LIMITED.—Capital £30,000, to acquire the Tuckingmill Foundry, at Camborne, Cornwall.

GILBERT THOMPSON & COMPANY, LIMITED.—Capital £5,000, to carry on the business of constructional and mechanical engineers, etc.

J. FYFE DONALD & COMPANY, LIMITED.—Capital £10,000, to acquire the business of J. F. Donald & Company, Johnstone Foundry, Johnstone.

GARTER FOUNDRY COMPANY.—Capital £5,000, to acquire the business carried on by F. W. T. Hartland, Garter Foundry Works, West Bromwich.

NORTONS (TIVIDALE), LIMITED.—Capital £5,000, to carry on the business of bridge builders, ironfounders, etc. Registered office: Hecla Works, Tividale, Staffs.

SHEFFIELD TOOL AND GAS ENGINE COMPANY, LIMITED.—Capital £5,000, to acquire the business carried on by F. Cam, at Porter Lane, Sheffield, as the Sheffield Tool and Gas Engine Company.

GRANVILLE BRASSFOUNDRY COMPANY, LIMITED.—Capital £1,500, to acquire the business of Messrs. Holt and Ashmore, 130, Granville Street, Birmingham, known as the Granville Brassfoundry Company.

JOHN MANWOOD, LIMITED.—Capital £3,000, to take over the business carried on at Dukinfield and Ashton-under-Lyne as John Manwood, and to carry on the business of sheet-metal workers, ironfounders, etc.

R. LAIDLAW & SON, LIMITED.—Capital £50,000, to acquire the goodwill, etc., of R. Laidlaw & Son, Limited, 147, East Milton Street, Glasgow, and forming the Edinburgh branch of their business of gas and water meter manufacturers and brassfounders, carried on in Simon Square, Edinburgh.

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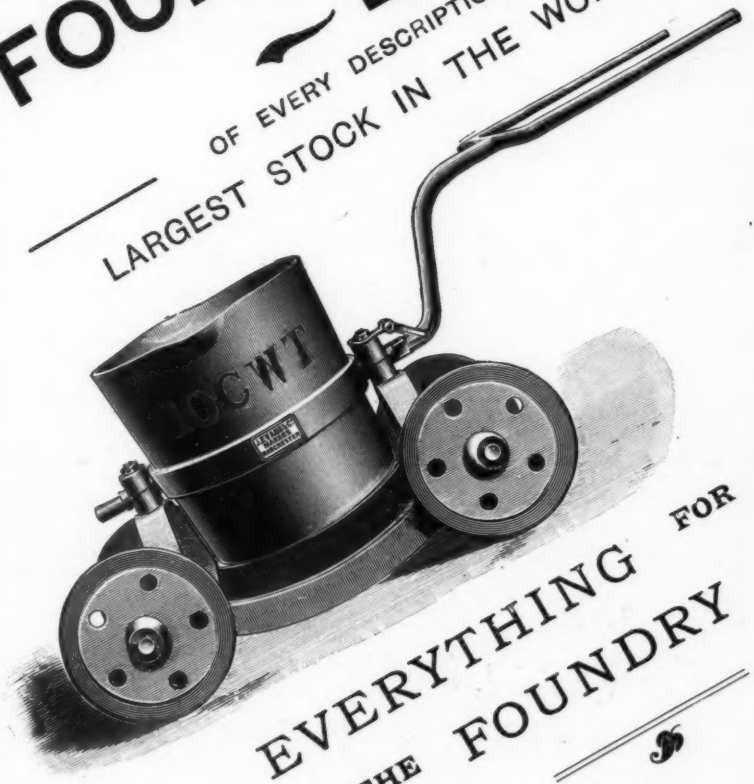

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DEATHS.

MR. J. T. AVERHILL, cashier to the Rhymney Iron Company, at the age of 48 years.

MR. ALFRED HILLS, for many years a director of William Jessop & Sons, Brightside, Sheffield.

MR. J. WOODCOCK, one of the oldest members of the Sheffield edge-tool trade, who established the firm of James Woodcock & Sons, Trafalgar Works, Young Street.

MR. J. A. JONES, who for many years was intimately connected with the manufactured iron industry of the North of England. Mr. Jones, in conjunction with his brothers and Mr. Ayrton, of Saltburn, established the firm of Jones Brothers & Company, who erected and carried on for many years the Ayrton Rolling Mills, Middlesbrough, and also started cut-nail works on an adjoining site which works were subsequently acquired by Messrs. R. P. Dorman & Company, Limited, and then by Messrs. Dorman, Long & Company.

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Steel Moulders' Composition, Silica Cement.

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DEEPCAR, nr. SHEFFIELD.
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HAND AND POWER MOULDING MACHINES.
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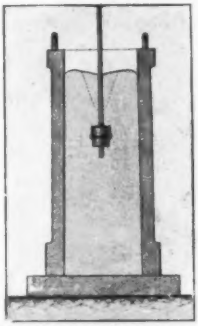

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As supplied to the British . . Admiralty Dockyards.

The following, selected from numerous letters, are eminent testimony as to the quality of our celebrated "A.A.A." Coppee Foundry Coke, carefully selected, and despatched in sheeted wagons.

From PECKETT & SONS, Bristol.

Bristol, October 25th, 1904.

We have been using your Selected Foundry Coke for some considerable time.
We have pleasure in stating that we are very pleased with it, as we find we get sounder and cleaner castings, more free from blow-holes and other defects, than we formerly did.

From MOUNTFORT PHILLIPS & Co., Llantrissant.

Llantrissant. October 25th, 1904.

In reference to the Foundry Coke you have been supplying us with for the last six months, we have very great pleasure in letting you know that it has given every satisfaction, and that our Works Manager and Workmen give it the highest praise.

Elders Navigation Collieries, LTD. Cardiff.

PRICES OF METALS.

The following table shows the approximate latest prices and position of stocks of metals during the past two years :—

Metals.	1903-7.	1905 6.
Iron—Scotch pig warrants ... ton	*63 6	59 9
—Middlesbro' warrants ... ... ton	53 8	54 9¼
—W.C. M/nos Bessemer ... ... ton	76 0	68 6
—Stock, Scotch, October 2 ... tons	1,570	11,064
Copper—Chili bars, GMB ... ... ton	£62 2/6	£93 2 6
—Stock, Europe & afloat... ... tons	12,138	12,483
Tin—English ingots ton	£161 0/0	£195 10 0
—Straits ... ton	£156 15 0	£195 0/0
—Stock, Ldn. Hlnd and afft ... tons	12,790	13,235
Lead—English pig ton	£21 15 0	£19 0/0
Spelter—Ord. Silesian ... ... ton	£20 17/6	£27 12/6
Quicksilver–(75lb.) bottle	£7 7/6	£7 0/0
Antimony—Regulus ... ... ton	£45-£46	£105 10/0

*Settlement price.

Castings.

In the Cleveland district the following are the nominal rates current for castings :—

	£ s. d.		£ s. d.
Columns (plain)	7 0 0	to	7 5 0
Pipes, 1½ to 2½ in.	5 10 0	to	5 15 0
,, 3 to 4 in....	5 2 6	to	5 10 0
,, 5 to 8 in.	5 0 0	to	5 2 6
,, 10 to 16 in....	5 0 0	to	5 2 6
,, 18 to 24 in....	5 0 0	to	5 2 6
Chairs	4 2 6	to	4 5 0
Floor plates (open sand)	3 7 6	to	3 15 0

Scrap.

The quotations for scrap, subject to market fluctuations, are as follows:—Heavy wrought (mixed), £2 14s. 0d.; light wrought, £1 12s. 6d.; heavy cast, £2 9s. 0d.; all per ton f.o.b., London. Copper (clean), £56; brass (clean), £43 10s. 0d; lead (usual draft), £19 15s. 0d.; tea lead, £18; zinc, £16 10s. 0d.; all per ton delivered merchant's yard.

SILICA FIRE BRICK Co.,

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GROUND GANISTER,

Wet or Dry.

Silco Cupola Bricks, 90 % Silica.

Better than Fire-clay Bricks for Cupolas.

Established 1863.

Jas. Durrans & Sons,

PHŒNIX WORKS, PENISTONE, Near Sheffield.

Manufacturers of all

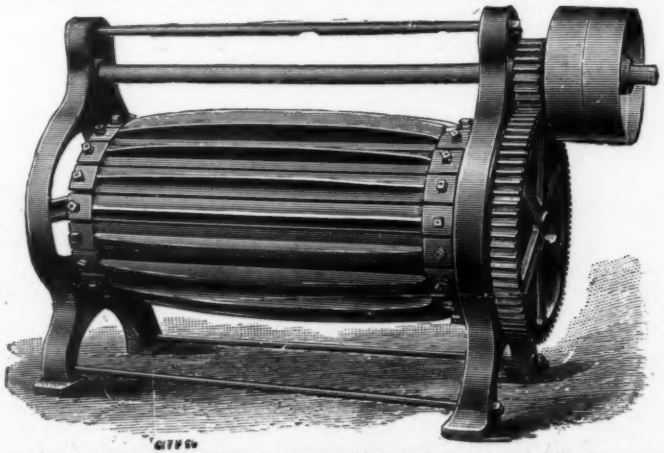
FOUNDRY EQUIPMENTS,

Composition Black Lead,

Plumbago, Core Gum, White Dust, and Coal Dust.

Ladles, Cupolas, Fire Bricks, Gannister, Stone Flux, Loam and Sand Mills, Casting Cleaners, Studs, Chaplets, Pipe Nails, Sprigs, Brushes, Wire Brushes, Core Ropes, Bellows, Buckets, Spades, Forks, Riddles, Sieves, Barrows, &c.

IMPROVED FOUNDRY RATTLER or FETTLING DRUM.



These Machines are invaluable for a Foundry, doing a larger amount of work of a superior quality, in a much shorter time than can be done by hand, without skilled labour.

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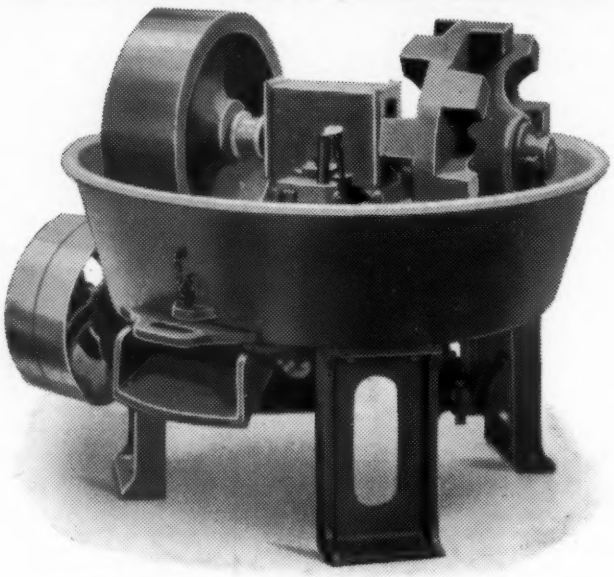

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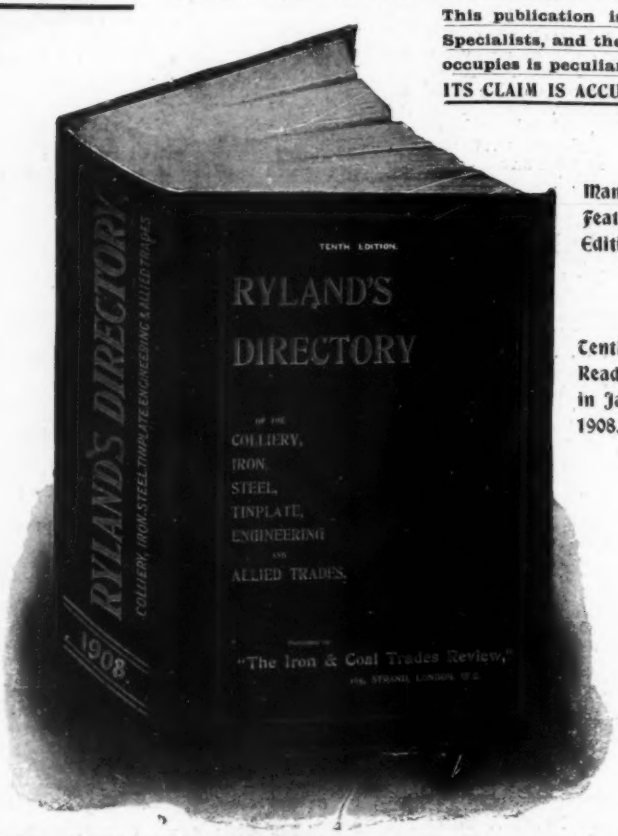

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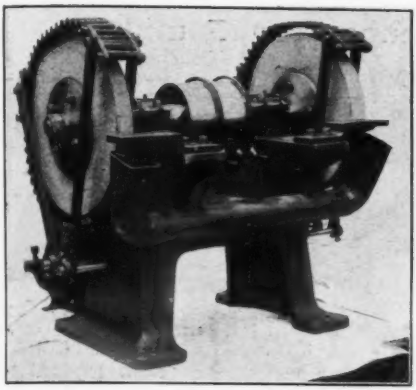

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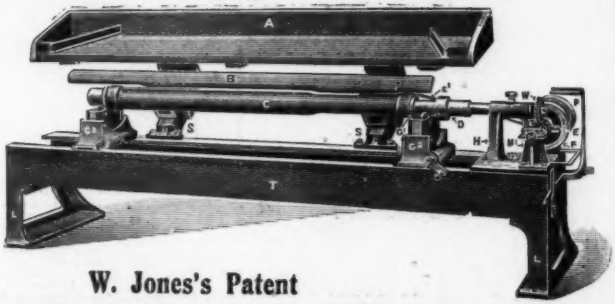

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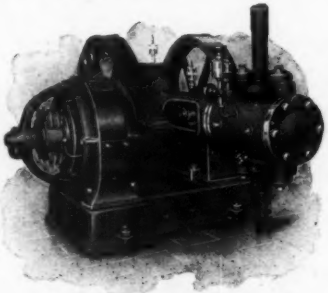

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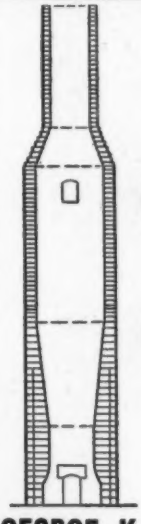

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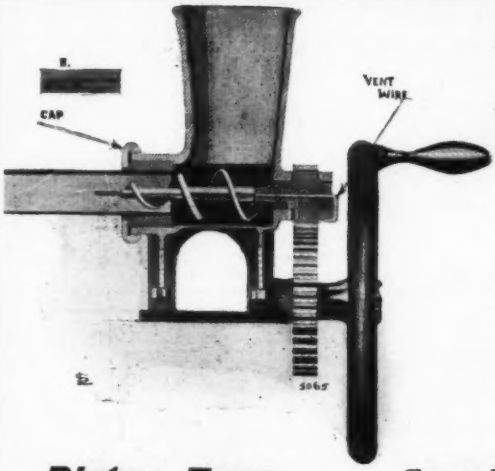

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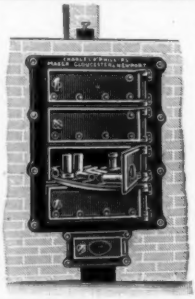

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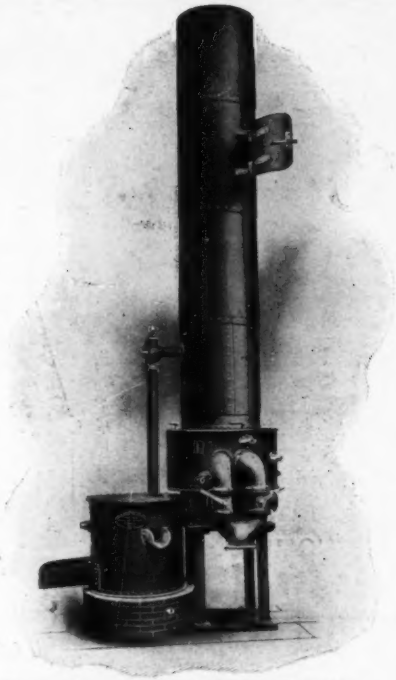

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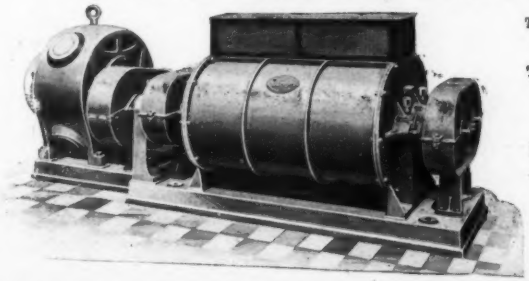

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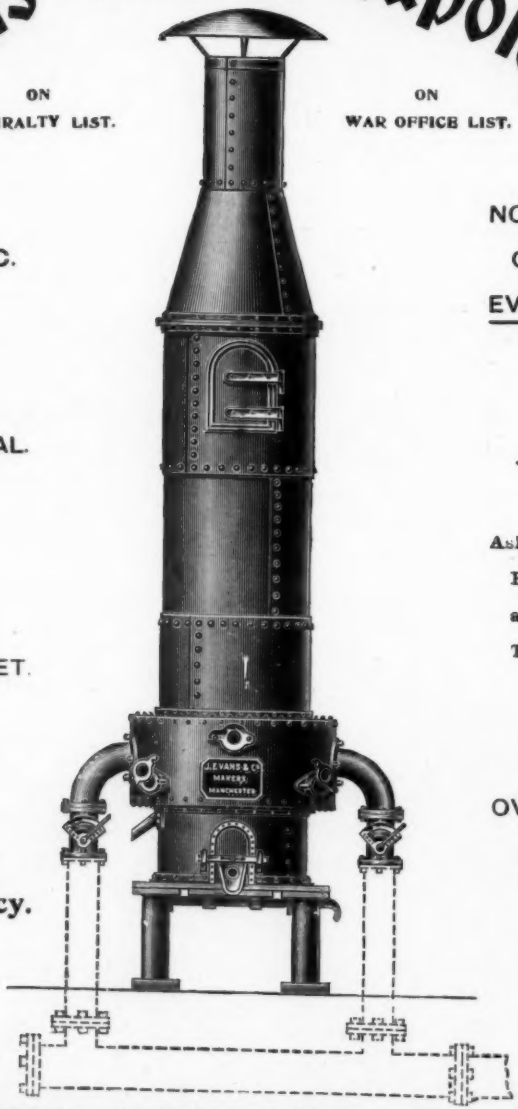

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